

POPULAR SCIENCE

FOUNDED MONTHLY 1872

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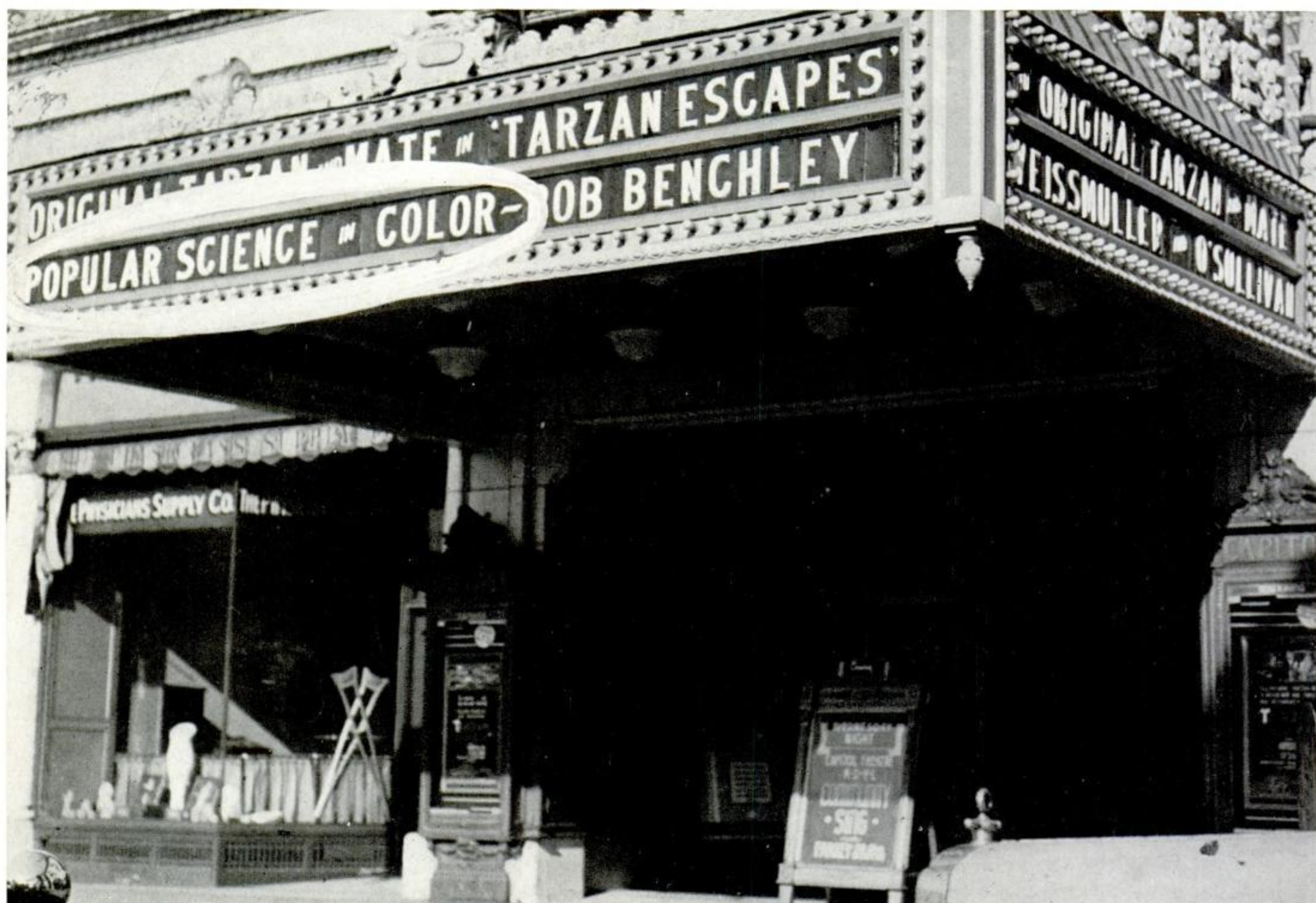
See Page 40

NEW INVENTIONS • MECHANICS • MONEY MAKING IDEAS
HOME WORKSHOP PLANS AND HINTS • 350 PICTURES

E. H. R. 1934
TRAVELIN'
WITH A C

Thousands Acclaim "POPULAR SCIENCE"

A Paramount Picture WITH SOUND AND COLOR



CAPITOL THEATRE, SALT LAKE CITY

Here's What They Say:

"One of the best one-reel subjects we ever ran. Excellent."

—New Piedmont Theatre, Piedmont, Mo.

"My audiences like Popular Science shorts on any program."

—Lyric Theatre, Brownwood, Texas.

"Interesting scientific facts, presented in a manner that struck the fancy of our patrons."

—Avalon Theatre, Clatskanie, Ore.

"These reels are in a class by themselves. Colorful, educational, interesting."

—Niles Theatre, Anamosa, Iowa.

"These Popular Science shorts are always popular with our patrons. They are interesting and out of the ordinary run of shorts."

—Capitol Theatre, Brownville, Texas.

"Believe this is one of the most interesting one-reelers we've played. Everyone enjoyed it and told us so."

—Pines Theatre, Waldron, Ark.

"Audiences like this subject very much. Heard several very fine comments—and noticed that at a packed house it held the attention of the entire audience."

—Gem Theatre, Brownwood, Texas.

"A very interesting short, and the beautiful color in it adds to its entertainment. The miniature railroad scene in color was marvelous. Everybody enjoys these shorts."

—Rio Theatre, Albuquerque, N. M.

"Excellent. Very interesting facts about the things around us in everyday life. Well presented and photographed."

—Rialto Theatre, Harlingen, Texas.

"These are the most interesting shorts that I have ever seen. They create a great deal of interest with our patrons. Give us more!"

—State Theatre, San Antonio, Texas.

"An excellent short subject, composed of topics that are interesting to everyone."

—Arcadia Theatre, Tyler, Texas.

"A Popular Science film is always welcome on our program."

—Tivoli Theatre, Fort Worth, Texas.

"Popular Science is a very well named short as it is very popular with our patrons. Excellent color. One of the most fascinating subjects yet presented was the glass-blower, made very effective by the color."

—Arcadia Theatre, Harlingen, Texas.

Ask YOUR Theatre to Show These Fascinating "Shorts"



Produced in Cinecolor by Carlisle & Fairbanks with the co-operation of the editors of Popular Science Monthly

NOISE STOPPED

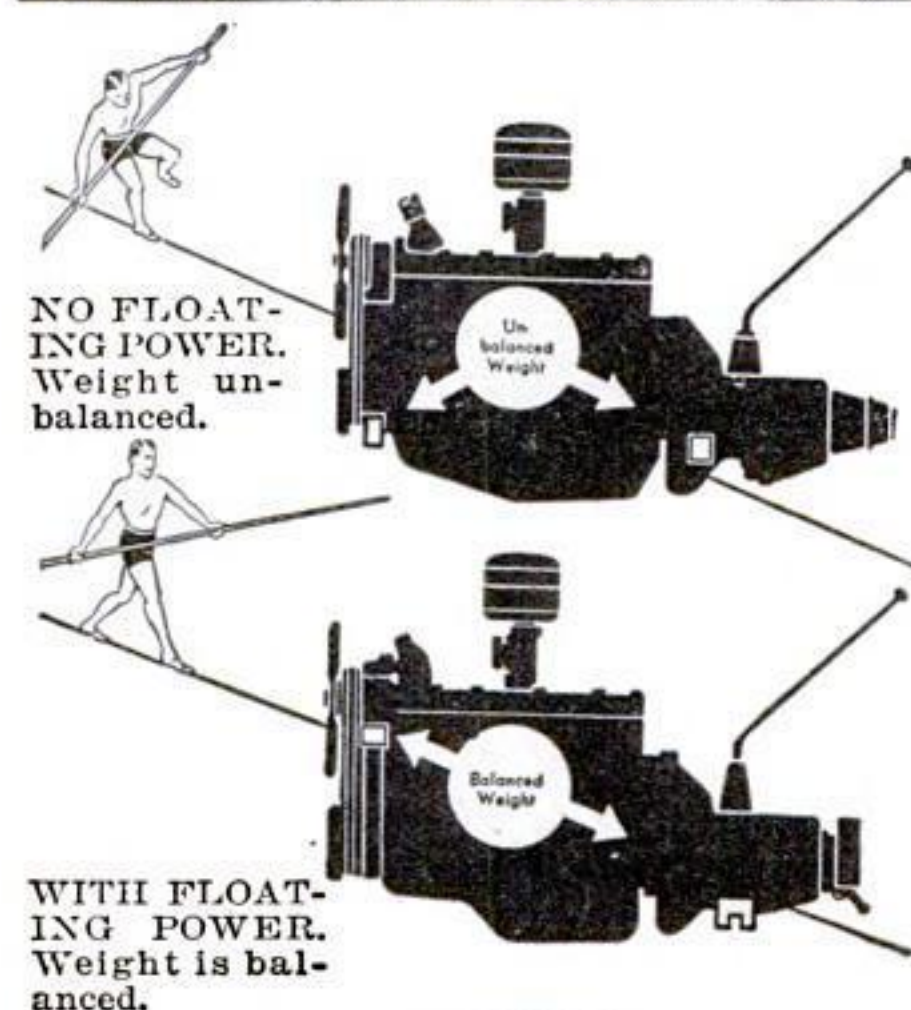
NEW CAR SOUND-PROOFED LIKE A BROADCASTING STUDIO



Five Kinds of Scientific Insulation Protect Your Ears

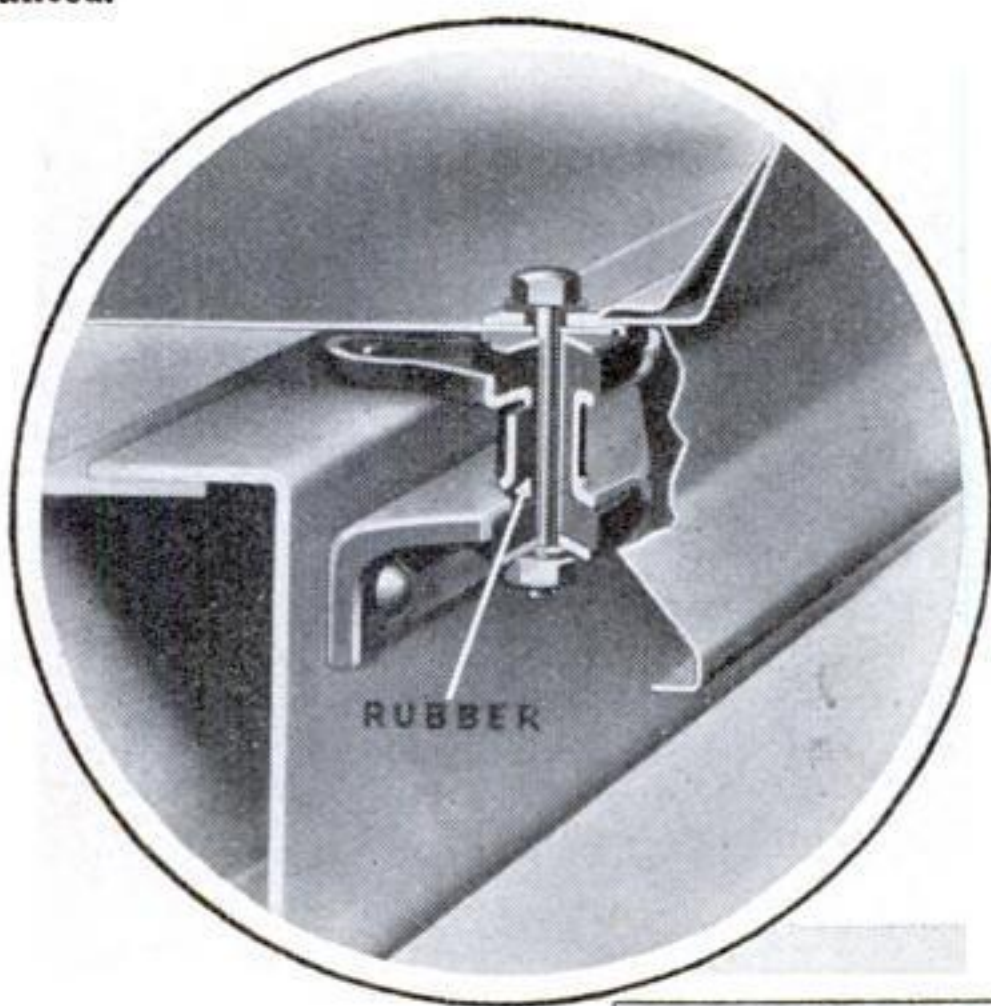
NOISE WEARS NERVES. Stopping noise increases motoring safety. That's why the remarkable sound-proofing of new Plymouth cars is one of the year's big automobile developments.

The engineers tracked down noise to its source, analyzed it, developed new ways to stifle it. Five materials are used. Road rumble, drumming and noise are now scientifically shut out or absorbed!



RESTFUL "Hushed Ride"...bumps and vibration killed by airplane-type shock-absorbers and new, live rubber cushions between frame and body.

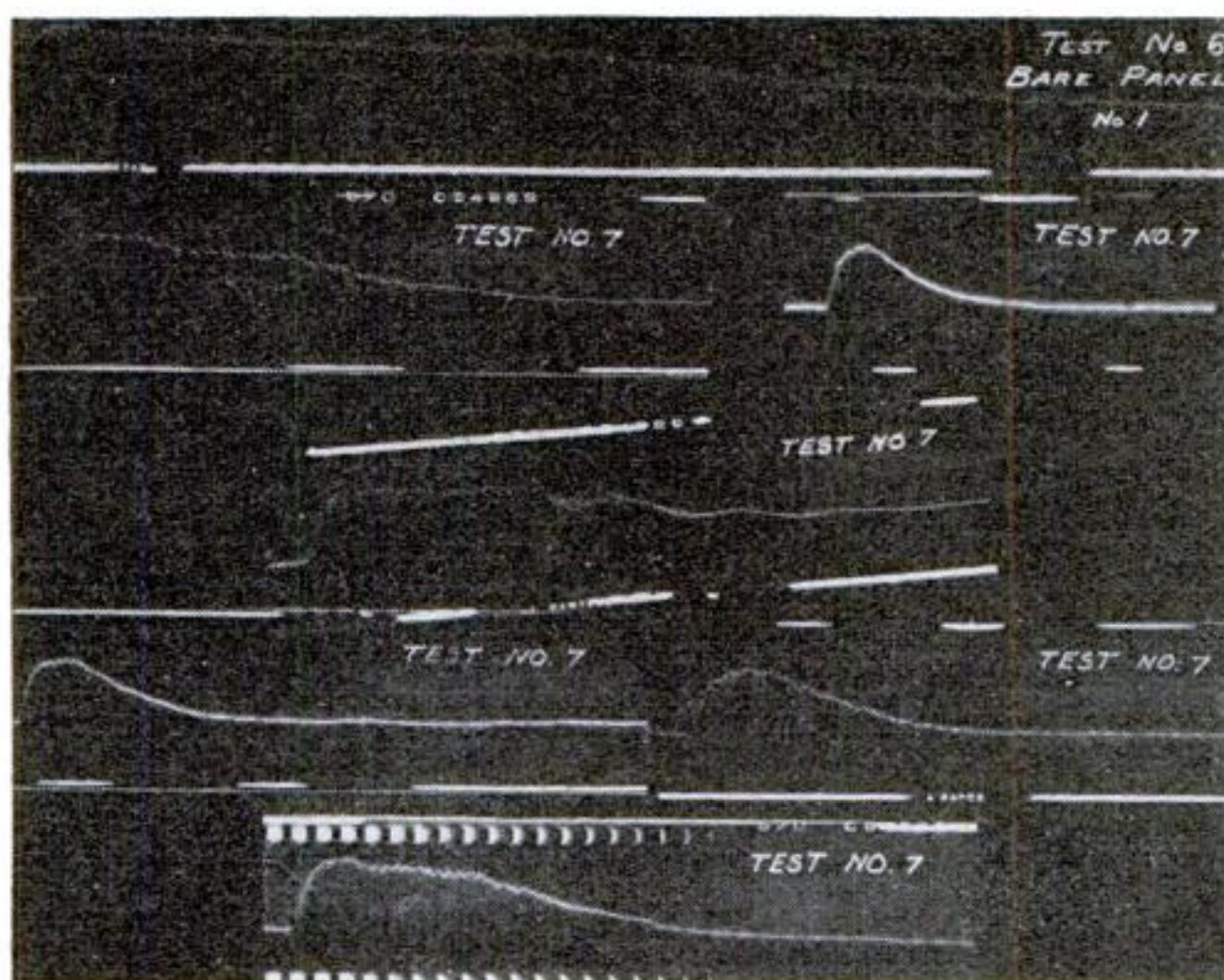
FLOATING POWER mountings (lower left diagram) keep engine perfectly balanced...dissipate vibration.



LIVE RUBBER mountings (above) between body and frame cushion the car from road shocks and vibration...add greatly to riding comfort.

EASY TO BUY

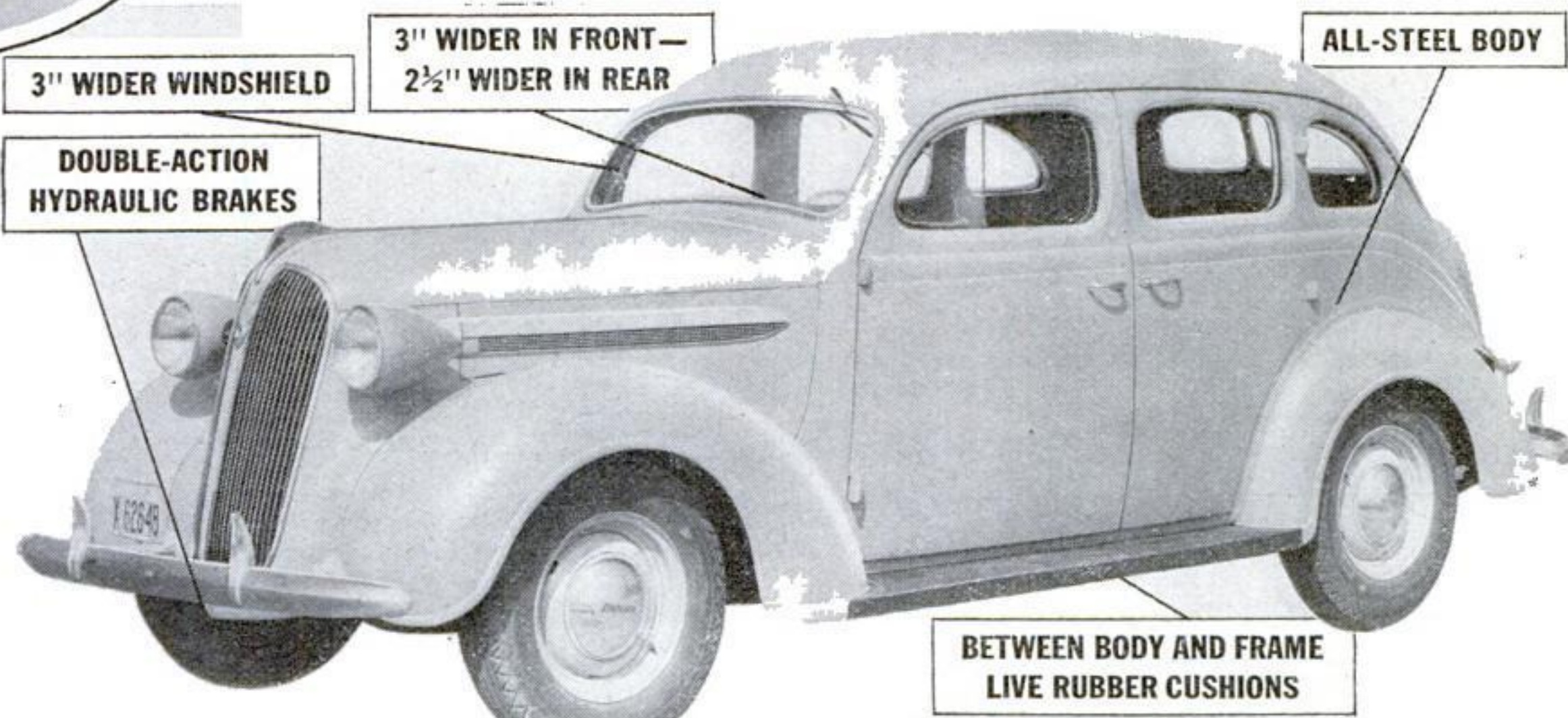
You'll find this beautiful 1937 Plymouth is priced right down with the lowest and the Commercial Credit Company offers low terms—through DeSoto, Chrysler and Dodge dealers. Plymouth Division of Chrysler Corp.



"BALD HEADS" (above)—formerly these round, rear corners reflected sound like a band shell. Now these noise-spreading spots have been scientifically silenced.

"SOUND MOVIES"... using cathode rays and a special movie camera, engineers took pictures of noise...enabling them to measure its exact pitch and frequency, and learn the efficiency of their new insulation.

(Below) The new DeLuxe 4-Door Touring Sedan.



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POPULAR SCIENCE

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TABLE OF CONTENTS for MARCH, 1937

Can We Read Each Other's Minds? 27

EDWIN TEALE describes some amazing tests that throw new light on telepathy

Crewless Lightships Controlled by Radio 30

Automatic warning devices replace men in perilous offshore stations

Photographer of Insects Records Strange Life Dramas 36

ANDREW R. BOONE lets you watch rare snapshots being made in nature's underworld

Circus Scout Finds New Thrills for the Big Top 38

A. MORTON SMITH introduces you to the man who discovers the stars of the arena

Strange Oil-Hunting Craft Runs on Land, Water, or Mud 40

How prospectors invade marshes with "divining" instruments, told by GROVER C. MUELLER

Science Catches Up with Fiction 48

Weird dime-novel "inventions" that have come true

Raise Your Own Wool on a Back-Yard Rabbit Ranch 50

Some pointers from JOHN E. LODGE on a pleasant and profitable hobby

Boys Build Battleships in Navy-Yard Apprentice Schools 56

KENNETH M. SWEZEY shows how Uncle Sam trains men to forge his new sea defenses

March, 1937, Vol. 130, No. 3.
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FEATURES AND DEPARTMENTS

<u>Our Readers Say—</u>	6
<u>New Tools for Home Building</u>	14
<u>The Man With the Net</u>	43
<u>Un-Natural History</u>	63
<u>Latest Household Inventions</u>	64
<u>Ghost Lights in the Sky</u>	66
<u>Home Tests with Chemical Colors</u>	68
<u>Microscope Stains and Reagents</u>	70
<u>Simple Scientific Stunts</u>	72
<u>New Ideas for the Radio Fan</u>	73
<u>An Arm-Chair Radio Set</u>	74
<u>Your Car's Thermostat</u>	76
<u>The Home Workshop</u>	77

Cover Design by EDGAR F. WITTMACK

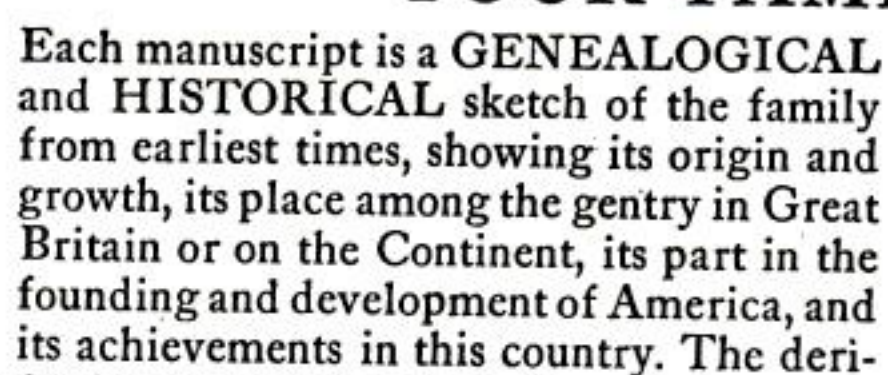
AUTOMOBILES

<u>Cars Get Antiskid Device</u>	45
<u>Water Jets Prevent Shocks</u>	52
<u>Novel Engine Tester</u>	54
<u>Starts Motor to Warm It</u>	54
<u>Tests Car Headlights</u>	55
<u>Springs Make Wheels Safe</u>	60
<u>Kinks for Auto Owners</u>	98

AVIATION

<u>Planes Get Lightweight Wings</u>	32
<u>Generates New Aviation Fuel</u>	34
<u>Plane Replants Forest</u>	34
<u>Mental Effect of Altitude</u>	35
<u>Airport Has Mile-Long Runways</u>	42

BELOW is a list of surnames of some of the most distinguished American families. Our research staff, over a period of years, has completed preparation of manuscripts dealing with the history of each of these families. If your name is listed, you should have a copy of your manuscript. You will find it not only of keen interest, but a source of pride and satisfaction to yourself and your kin.



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POPULAR SCIENCE MONTHLY FOR MARCH, 1937

Helicopter to Cross Ocean . . .	44
Gas Primes Cold Motors . . .	53
Glider Rides Cable Car . . .	58
New "Flivver" Plane Tested . .	59
16 Men Ride under Plane Wing .	62

MODELS

Kits for Brig Model	20
Builds Model of Excavator . . .	33
A New Brig Model	77
Model of Famous Old Coach . .	83
Foliage Made from Rubber . . .	92
Tiny C-Clamps from Earrings . .	103
Automatic Crossing Gates . . .	110
Routing Model Trains	111
Reel Keeps Rigging in Order . .	111

NEW PROCESSES AND INVENTIONS

Hose Nozzle Increases Range . .	32
New Egg-Preserving Process . .	33
Device Prevents Ether Nausea . .	34
Slot Machine Shines Shoes . . .	35
Device Makes Ribbons of Ice . .	42
Dog Harness Provides Handle . .	42
Television Scans Ocean Floor . .	42
Plastic Aids Lighting Effects . .	43
Headlamp Wigwags Warning . . .	44
Self-Feeding Typewriter	44
Toothbrush Has Pivoted Head . .	44
New Machine X-Rays Oranges . .	45
Locomotive Reclaims Its Water . .	45
Sand Bath Dry-Cleans Coal . . .	47
Meter Gauges Sun's Rays	52
Self-Steering Roller Skates . . .	52
Multiple-Ribbon Typewriter . . .	53
Teething Ring Holds Bottle . . .	53
Make-Up Kit Has Flash Light . .	54
Stretches Tight Shoes	58
Tricycle Runs on Air	58
Streamline Golf Club	59
Time Clock Is Tamperproof . . .	59
Shows When Concrete Is Dry . . .	60
Wrench Has Pressure Gauge . . .	61

Light-Socket Telephones	61
Telephone Poles Telescope . . .	62

PHOTOGRAPHY

Photographs Body's Joints . . .	33
Huge Tanks Wash Prints	55
Synchronizer Times Shutter . . .	58
Movies Show Blood Cells	62
Homemade Spotlight Costs \$2 . .	96
Low-cost Lamp Stand	96
Storing Miniature Negatives . .	105
Many Uses for Film Tank	105
Lens Cap Yields Odd Photos . . .	106
Printing Weak Photo Films . . .	119

RADIO

Radio Tower 640 Feet High . . .	43
Use Radio Stethoscope	52
Fourteen-Ounce Radio Set . . .	53
Mouse Sings on Radio	62

UNUSUAL FACTS AND IDEAS

Records Cockroach Heartbeats . .	32
Sounds Speed Seed Growth . . .	33
Bell Warns 'Quake Observers . .	33
Truck Carries Oil Rig	34
Rescue Landlocked Fish	35
Master Clock Splits Seconds . .	35
Mechanical "Carrier Pigeon" . .	43
Man Beats Horse in Speed Test . .	44
Weigh Checks to Save Counting . .	45
Boy Has Own Animal Museum . . .	45
Catches Alligators for Zoos . . .	46
Polarized Light for Puppets . . .	52
Pen Speeds Cattle Branding . . .	53
110-Pound Book Handwritten . . .	54
Marine Derrick Launches Boat . .	54
Recordings Improve Speech . . .	55
Novel Modernistic Greenhouse . .	55
Artificial Mouth Tests Phones . .	55
Homemade Electric Snowplow . .	58
Blast 1,000,000-Ton Block	59
Rare Watch Collection	60
Outboard Drives Water Sled . . .	60

Giant and Dwarf Harmonicas . . .	60
Ant Homes Show Insect Life . . .	61
Pipes Bring Gas 1,200 Miles . . .	61

WOODWORKING

Telephone Table and Stool	83
Slant-Top Writing Desk	83
Early American Armchair	83
Colonial Dressing Mirror	86
All-Turned Smoking Stand	86
Useful Little Pine Chest	87
Home Workshop Blueprints	107

IDEAS FOR THE HANDY MAN

Cabinet for Microscope Slides . .	81
Camp Stove Heats Materials . . .	82
Sheet-Copper Desk Lamp	82
How to Put Your Skis Away	82
A Toy Drill Press	83
Modern Metal Moldings	84
Tool Removes Bushings	84
Rack for Grease Guns	84
Making an Electric Timer	85
Inner-Tube Springs for Crib	87
Flawless Balloon Ceiling	88
How to Restretch Webbing	89
Installing a Kitchen Light	90
Stopping Shingle-Roof Leaks . . .	90
Homeworkshop Guild News	91
Holders for Easter Eggs	92
Paper Weight Holds Magnifier . .	92
New Tools for Drill Press	92
Improved Carpenter's Boxes . . .	93
Homemade Spindle and Buffs . . .	94
Carved Refreshment Trays	95
Box Holds Jig-Saw Blades	99
Sharpening a Glass Cutter	99
Unique Electric-Arc Torch	100
Jig Helps Assemble Drawers . . .	101
Oil Prolongs Razor's Life	101
Brilliant New Enamels	102
Avoiding Light-Switch Smudge . .	111
Making Oval Picture Frames . . .	112
Old Bill Says—	120
Solution for Working Glass	122
Iodine Used to Tint Shellac . . .	122



save

HOW MUCH DOES THE TELEPHONE ~~COST?~~

It is easy to figure how much the telephone costs. It is not easy to reckon how much it saves.

A single telephone call may save a life—brighten a friendship or a day—sell a bill of goods or land a job.

One telephone call may be worth more to you than the cost of the service for months and years to come.

The telephone saves you priceless hours of time each week—spares you trips through snow and storm these uncertain winter days.

Without moving from the warmth and comfort of your own fireside, you are in touch with stores and friends and office—by telephone. The cost is but a few cents a day. In return, the telephone offers you

increasing measure of security, convenience, happiness and achievement.

Every time you call a number, you use some part of a nation-wide telephone system that cost more than four billion dollars to build and employs about 300,000 people. The facilities of this entire organization are yours to command—anywhere, any time, and at small cost.



BELL TELEPHONE SYSTEM

Our Readers Say



A Veteran Model-Gun Maker Tells How It's Done

MODEL gun making, in which some of your readers have shown interest recently, is one of my hobbies, and I, too, would like to see you give some space to articles on this subject. Model guns should be built to a definite scale, just like model ships or trains, and I have found that a one-to-four ratio is very good. I made a model of a .52 caliber buffalo gun in this size. It has a sliding drop breech, steel frame, sidelock and barrel, and walnut stock and fore end. It looks like a real gun and works like one, the actual caliber being .13. A scale of one to three is very good, too. I have worked with this, and intend to use it in the construction of a Remington cap-and-ball rifle. I expect to make it shoot, using a cigar-lighter flint. The best way to start the hobby of miniature gun making is with wooden models, which are easy for anyone to whittle. As one gains skill and knowledge of the different types of guns, one can advance to the more elaborate models. I began this way when I was ten years old.—J.R., Ava, Ill.

NOW IF I HAD
SOME SCALE
DEER TO
SHOOT!



Yes, the Law of Gravitation Is Still in Force

So B.L.L. was fooled by the old Mount Freedom illusion, was he? We've all known for years that water won't run uphill. Why should we expect our cars to coast upgrade? The explanation of the phenomenon is this: the road up from Morristown to Mount Freedom is so darn steep most of the way that when it does level off a little bit it actually looks as if it were a down grade (or up grade, depending upon which way you're traveling). You really were coasting down hill, B.L.L., and you can prove it with a carpenter's level.—G.A.O., Dover, N.J.

Reader Is Overcome By Gas-Mask Items

It's a cheerful prospect you hold out for the so-called human race, in a recent issue. On one page, a baby slumbers peacefully in its gasproof shelter; on the next, a gentleman sits at his desk with a gas mask on and engages in a telephone conversation, presumably while the deadly fumes eddy around him. Apparently, our wonderful civilization will not reach its peak until every man, woman, and child is wearing a mask every minute of the day—eating and sleeping, working and playing. Eventually, nature may come to the rescue by equipping us with built-in gas filters, and so save us from killing ourselves off. Not that it matters much.—A.T.J., Jr., Birmingham, Ala.

H'M, JUST ANOTHER
ONE OF MY
MISTAKES!



Maybe It's Used With a Perpetual-Motion Engine

LATELY I've been hearing of a fellow in Canada who is said to have invented a carburetor that will run an automobile 200 to 400 miles on a gallon of gasoline. My brother argues that it would be impossible to get that much energy from a gallon of gas. We are turning to P.S.M. for help. Can any of your readers help us settle this argument?—J.J.A., Elwood, Ind.

He's Worried About the Size of Raymond Wailes's Lab

YOUR chemistry and microscopy articles are high points with me, and of course, I "gobble them up." By this time, however, the laboratory of the man who writes the chemistry articles must be overflowing into the coal bin, preserve closet, and ash barrel! How about an article (or even more than one) on rearranging the shelves, cabinets, drawers, hood, and the rest of it to allow for growth? My lab has long since outgrown its former limits. After that business is accomplished, I feel sure that other readers will join with me in wanting articles on organic synthesis. Such projects could be done with simple, homemade apparatus, and chemicals obtained at the corner drug store. In some future issue I would like to see some plans for home-workshop construction of spotlights, flood lights, and other equipment for small stages such as are encountered in churches and schools. The amateur electricians would have a great time rigging up lights of this type, as most small stages are pitifully lacking in proper lighting fixtures. Low-cost rigs could be built of pie tins, old pipe, and colored transparent cellulose. Whether or not you accept my suggestions, P.S.M. is still the leader. More power to you!—W.L.B. Jr., Needham, Mass.

SURE, YOU CAN GO
TO BED AS SOON AS
THIS EXPERIMENT
IS FINISHED!



Only Nice Snakes Live In the Galapagos Islands

MAY I send a great big, fragrant bouquet, and a tiny, well-meant brickbat? I enjoyed your recent article, "Snakes Are His Friends," because reptiles are my hobby, too, in a small way, and I was glad to see that it was so accurate in its presentation of facts. Accuracy is a little detail too often neglected by the authors of the kind of snake article which appears in the average publication. Now for the brickbat: one little error did creep in; perhaps it was because the writer got his geography mixed. There are no rattlesnakes on the Galapagos Islands, and, as far as the word of recognized authorities is concerned, no poisonous snakes at all. Snakes are found on the islands, but all of them are harmless. I might suggest that the author may have been think-

ing of some of the islands in the Gulf of California, where there are said to be huge rattlers.—R. a'D., Mexico City, Mexico.

You Might Try This Out With Next Week's Wash

HAVING been caught nicely on this little problem, I'd like to pass it on to the mathematically inclined among your readers: Fifty pairs of blue socks and fifty pairs of red ones are piled on a table; the pairs are separated, so that there are 100 red and 100 blue socks, all mixed together. A blindfolded person is brought into the room and starts picking up the socks. How many will he have to pick up to be sure that he has at least one pair of the same color?—J.D., Dover, Del.

EENIE, MEENIE!



Two Times Two IS Four, Webster Always Said

THREE CHEERS for P.S.M.! It certainly is a fine magazine. This fall, I built the one-tube receiver described in your July issue, and can get England, France, Germany, and a number of South American stations any evening. Not bad! I enjoy reading the articles on radio, even though I don't have the "wherewithal" to build many of the sets. How about an article and diagrams for an automobile radio? I like the home-workshop, amateur-photography, and "Gus and Joe" articles, too. I disagree with H.G.P., Bangor, Me., on the subject of "painless" arithmetic. As a boy, I hated nothing so much as figuring out problems by the use of so-called "pegs." And, by the way, which is correct, "nine times eight is seventy-two," or "nine times eight are seventy-two"?—J.W.C., Fitchburg, Mass.

Sponsor Replies to Critics Of Vacuum Leaf Remover

Is a reader whose brain child was published in Our Readers Say allowed to reply to the letters of comment, regarding the idea, that have appeared in later issues? E.C.P., of Cincinnati, Ohio, expresses a fine bit of humor when he suggests "eau de burning leaves" for use with my vacuum leaf remover, but I wonder whether he knows that a modification of his idea is actually in use in household vacuum cleaners, some makes of which have chambers for perfuming crystals. To allow leaves to remain on the ground, as suggested by S.Z., Chicago, Ill., would cause a return to the "leaf age" in this (Continued on page 7)

OH, YEAH!



OUR READERS SAY

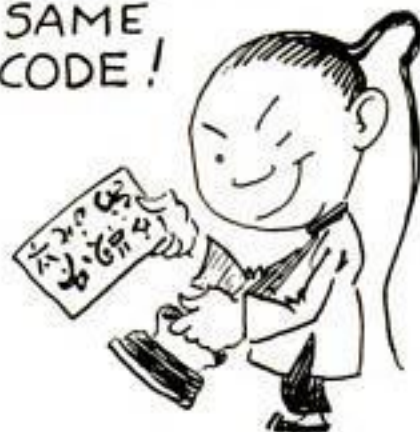
(Continued from page 6)

part of the country where so many of our trees are blackjack and scrub oak.—H.L., Siloam Springs, Ark.

Our Typesetter Says He Has Enough Trouble Already

WHY not have some articles on secret codes and how to decipher them? You could give us one or two code messages each month to decipher, publishing the answers a month or two later. This is one of my hobbies, and I find it most interesting. There probably are several readers like myself who would like to try their hands at deciphering each other's code messages. I'll make up a good one and send it to you very shortly.—F.K., Shelbyville, Ind.

LAUNDLEE
TICKEE ALL
SAME
CODE!



Slow-Cooling Teapot Cost Him a Hat

HERE'S a tricky problem in physics that cost me a new hat. My wife made the statement that tea brewed in a silver teapot keeps its heat better than if brewed in a porcelain pot. Knowing that silver is an excellent heat conductor and porcelain a poor one, I scoffed at that remark and bet her a new lid. Well, we tried it out with two teapots of about the same size, filling each with the same amount of boiling water and testing with a thermometer at two-minute intervals for more than half an hour. The result of the experiment was that the water in the porcelain pot lost its heat much more rapidly than that in the silver pot, and I had to fork over for a new bonnet. I've racked my brains, but for the life of me I can't explain why. Can any of your readers help me out?—M.W.E., New York City.

Something More for Admirals To Lose Sleep About

AFTER reading your article "New Ships Change Naval Warfare," I wondered whether the battleship really remains the mainstay of a fleet. How would a battleship protect itself against a crewless, radio-controlled speedboat loaded with high explosive and using a television broadcasting outfit for steering by the controlling vessel. Torpedo nets around the battleship would be ineffective against the attack of heavy boats of this type.—E.W., Chicago, Ill.

I DIDN'T HAVE
RADIO AT ANNAPOLIS,
SO WHY
BRING
THAT
UP?



Candid Words from a Miniature-Camera Fan

ONE of the things that impressed me, on a recent visit to New York City's new Central Park zoo, was the number of people carrying modern miniature cameras. I counted seven cameras, each of which cost a hundred dollars or more, in less than half an hour. This certainly goes to show the large number of amateurs who are seriously interested in picture taking, and I suspect that not a few of them were started off on the right track by P.S.M. Your articles have covered almost every phase of photography, but some parts have been taken up more completely than others. I wish you would give us more on candid-camera tech- (Continued on page 8)



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OUR READERS SAY

(Continued from page 7)

nique, and especially the use of a miniature camera in taking pictures of the actors on the stage of a theater, along with other difficult "shots." One of your readers asked for plans of a photostat camera, and I think such an article would be well received. There must be hundreds, if not thousands, of your readers who, like myself, keep scrapbooks on the different subjects in which they are interested, and who have to put up with the many annoyances of pasting in clippings. If we could make photostats of magazine articles and other information, the scrapbooks would be neater and more durable. Also, we could record information from library books and other sources from which it would be impossible to cut clippings. It seems to me that it would be possible to build a simple and practical photostat machine, using the lens from an old hand camera.—E.K.C., Springfield, Mass.

Our Apologies To the Folks Of the Upper Peninsula

IN A recent issue you had a very interesting article titled "Odd Fishing Carnival," which told about the smelt runs in the Great Lakes region. Your main facts are quite correct, but you are in error when you say that Crystal Lake is in northwestern Michigan. Had you said, "in the northwestern part of the lower peninsula of Michigan," you would have been more accurate. If you will examine your map of Michigan, you will discover that the state stretches more than 300 miles in a northwesterly direction from Crystal Lake. Michigan is not bounded merely by Lake Michigan and Lake Huron, but along its northern boundary by Lake Superior. This letter is being written more than 300 miles northwest of Crystal Lake, on the so-called Keweenaw Peninsula, which juts out into Lake Superior. We of the upper peninsula like to be included in the state of Michigan.—Dr. A.B., Laurium, Mich.

SO THAT'S
MICHIGAN



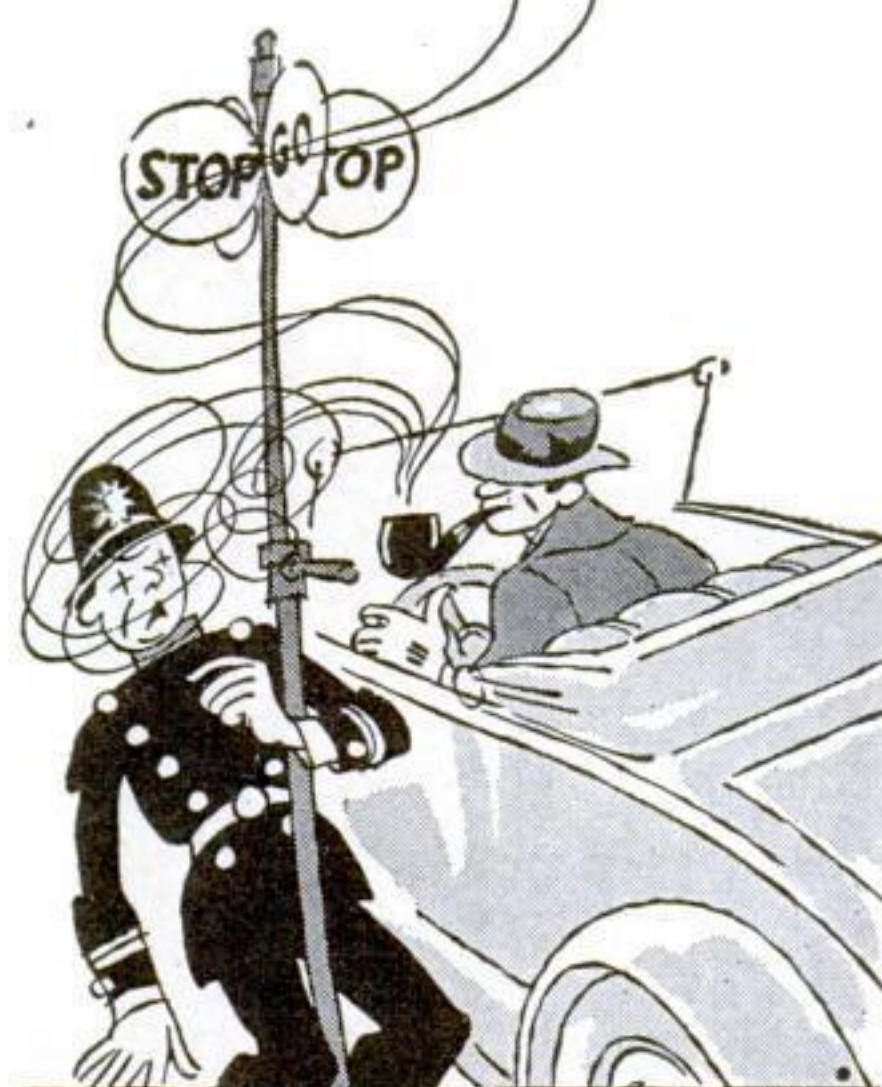
O.K., If You Can Find Enough People To Join

WHY do scientists persist in saying that meteors come from outer worlds? It is a well-known fact that whatever goes up must come down. That applies to heavenly bodies, too. If the meteor eventually comes back to earth, how in the world could it be thrown off other planets? The meteor is born and dies on earth. It rises in dust form and comes back as a solid. Remember that the range of man's eyesight is only thirteen miles high, and what goes on above that height has yet to be proven. Why not form a common-sense club to help dispel foolish ideas?—M.T.L., Brooklyn, N. Y.

An Amateur Lapidary Likes Gem-Cutting Articles

I WAS greatly interested in the article on gem cutting published in a recent issue of your magazine. I am a beginner in the business of cutting and polishing specimens, and the information given was the clearest and most concise I have ever seen. I had often wondered why this very interesting hobby had not been taken up in P.S.M. If more people knew the thrill one gets out of seeing a rough stone take shape, and seeing the beauty brought out in the final polishing, I am sure this hobby would (Continued on page 9)

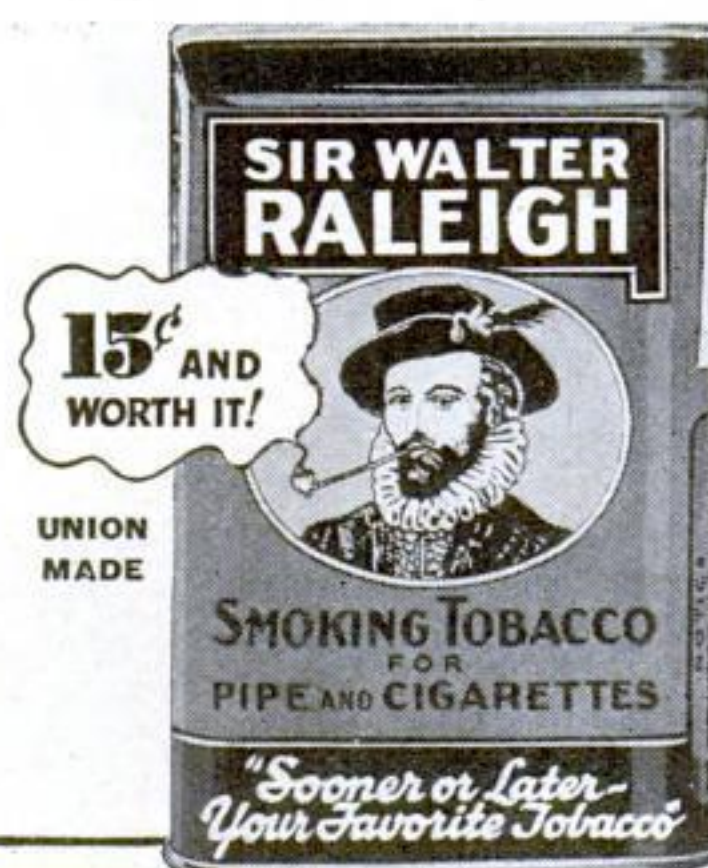
DIRTY WORK AT THE CROSSROADS!



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grand aroma



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OUR READERS SAY

(Continued from page 8)

become firmly established. Rough gem material can be purchased from many sources, and it is well worth one's while to turn out a few beautiful specimens of cabochons. Calcite, while not so hard to work, makes nice specimens, and is a good material to start with. Agate, on the other hand, is pretty hard to use.—J.H.Y., Clair, Saskatchewan, Canada.

Another Pupil for the Class In Elementary Ship-Modeling

NEVER having had any experience in ship modeling, I heartily agree with J.R.C.D., Segamat, Malaya, on having simpler and more fully described projects. It also would be helpful if you would explain where the necessary equipment can be obtained. I like very much to do woodworking, and am sure that I would enjoy ship-modeling if I could get past the novice stage. Why not give us beginners a chance to start?—B.D., Philadelphia, Pa.



Cut-and-Try Methods, Says He, Are Best

OF ALL your features, I enjoy "Our Readers Say" most. Especially am I amused by the math sharks' efforts to solve some of the problems that come up, by means of algebra, trigonometry, etc. They always remind me of an anecdote about Thomas Edison. It seems that the inventor called upon a number of leading mathematicians to calculate the exact volume of an ordinary electric-light bulb. Each of them went into all sorts of intricate calculations, and while the answers were in general agreement, none were exactly the same. Whereupon Edison showed them how to get the exact volume of the globe by filling it with water, and measuring the quantity it would hold. I think most of us can learn a lesson from the story, and become a little more empirical.—S.I.N., Greenwich, Conn.

Racer Would Be By-Product Of Soap-Carving Hobby

How about giving us some instructions for carving things out of soap? Such articles should be very interesting. I would also like to second the motion of C.A.B. for simplified plans and instructions for an inexpensive soap-box racer.—M.H.L., New York City.

Not a Spy—Just Interested In National Defense

You certainly have a swell magazine, but how about some more stories concerning our Army and Navy? Now, don't get the idea that I'm one of those birds who run around in black cloaks and false mustachios, and try to get one of you gullible Americans to tell what kind of breakfast cereal the gobs eat, and so on. But I really do think you could sneak out some night and hit a general, admiral, or what have you, over the head and make him spill at least a few of the beans about our first, second, or third lines of defense.—J.F.S., Chicago, Ill.

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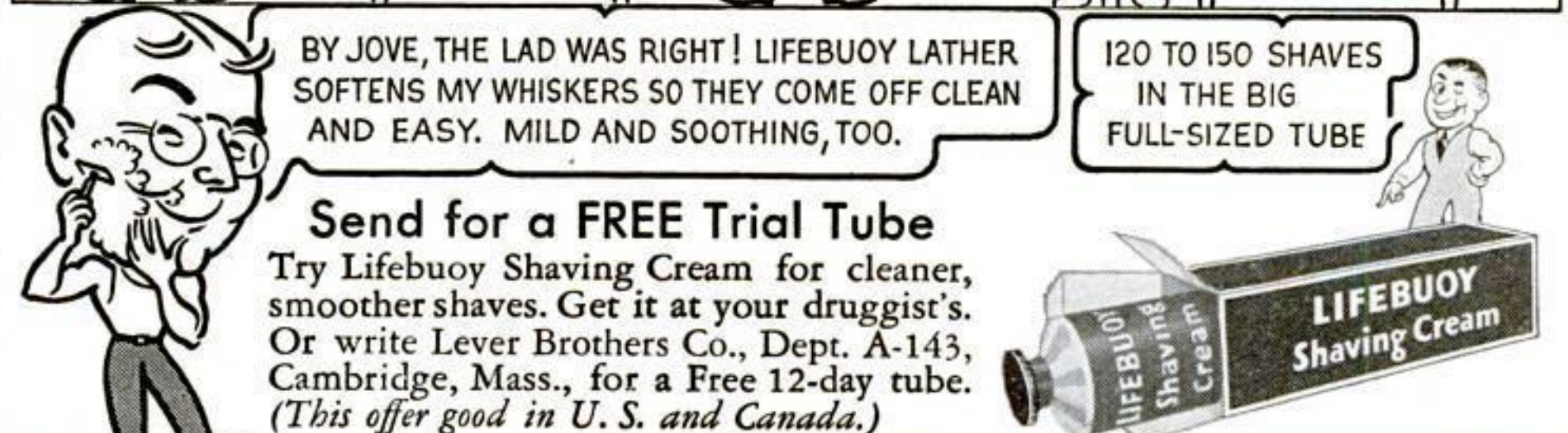
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Only letters from bonafide home study school students will be considered and these must contain the name of the school and the name of the company, or companies, for whom you have worked since graduation. We also want to know the kind of course you took and the type of position you have held. Your own identity will be kept anonymous, if desired.

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ENABLED HIM TO DO THE WORK HE LIKES

Conditions at home led to my leaving there at an early age and going on my own, with the result that my formal education was limited. But through home study courses I secured the training that has enabled me to earn my living at something I like to do instead of working at odd jobs all my life.

I had always wanted to draw and often lost out in arithmetic or other subjects because the teacher liked to have me decorate the blackboards for special days. I never objected to this, for I liked to draw and did not care much for arithmetic, but I realized after I got out of school that I did not know everything that I needed to know.

For a few years I worked at anything I could get, and more than once found myself very close to being hungry with no money with which to buy food. This led me to consider very seriously what I could do to improve the situation. I decided that in some way or other I was going to get the training I required to be an artist. When I talked the matter over with my father, he persuaded me to take mechanical drafting instead of illustrating, as he thought that was much more practical. There were no schools near us where the

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Secrets of Success

training was given, and besides I had to earn the money to pay for the course as I studied. So the correspondence course I took with the ——— School was the natural solution of my problem.

After I had completed part of the course, I was convinced that the drafting was not what I wanted, so the school allowed me to change to commercial illustrating. In connection with the drafting I had studied several subjects and passed with good grades—advanced arithmetic, algebra, geometry, etc.—that I know I would never have learned in public schools.

Soon after completing the course in illustration, I secured a position as designer for cut glass with the ——— Company. I worked there, at good salary, for five years, during which time I took an advanced course in illustration with the ——— School.

After I came west, I worked for a time with a leading daily newspaper. Not finding that job entirely satisfactory, I began doing free lance art work, doing all the art work for the ——— Advertising Agency, among other clients. Being offered a good position with a rubber company, I worked there for five years, doing the art work for their large advertising department—circulars, posters, newspaper and national magazine advertisements. For the past three years, I have again been free lancing and earning a fair living, much better than many others have been able to do during that time.

It is no exaggeration to say that due to the training that I secured through correspondence and home study I have been able all these years to earn a living by doing work I like rather than laboring at odd jobs I would dislike from every angle.—G. W. B., Denver, Colo.

HOME STUDY HELPS MASTER THE CLASSICS

Books and study have always deeply interested me, yet when I enrolled at ——— College in 1919 I had had less than a country school education. I longed to study fine arts and science—English, journalism, architectural drawing, school art—so these were my courses until sickness and lack of means prevented my finishing any of the correspondence work.

I began to teach art (having finished five terms in school art and almost all of my architectural drawing) and I wrote articles, essays, stories, and poems. My manuscript sold somewhat readily—among them an educational game to "The Progressive Teacher," and essay in a contest to "The Chicago Tribune," and an illustrated article in another contest to "The Southern Ruralist," for which I received the first prize. In addition, I sold several architectural drawings—one to the Federal Office at Washington.

But I stopped my writing to study for I could not resist the longing to become a master in the classical world. I continued my art teaching in order to provide the means with which to buy text books. I took a reading course from the Bureau of Education at Washington. But apart from it and the foundation that had been laid at ——— College, I had to study alone.

Success

while you are young enough to enjoy it

"I'M meeting Armstrong this afternoon at Ingleside—last chance for a little golf before we sail for Europe on the fifteenth . . ."

Pretty soft for Bob Carrington, you say—a lovely country home, golf on a week-day when the other boys are slaving at the office—a six weeks' trip to Europe with the family—and all this wonderful success while he is still young enough to enjoy it!

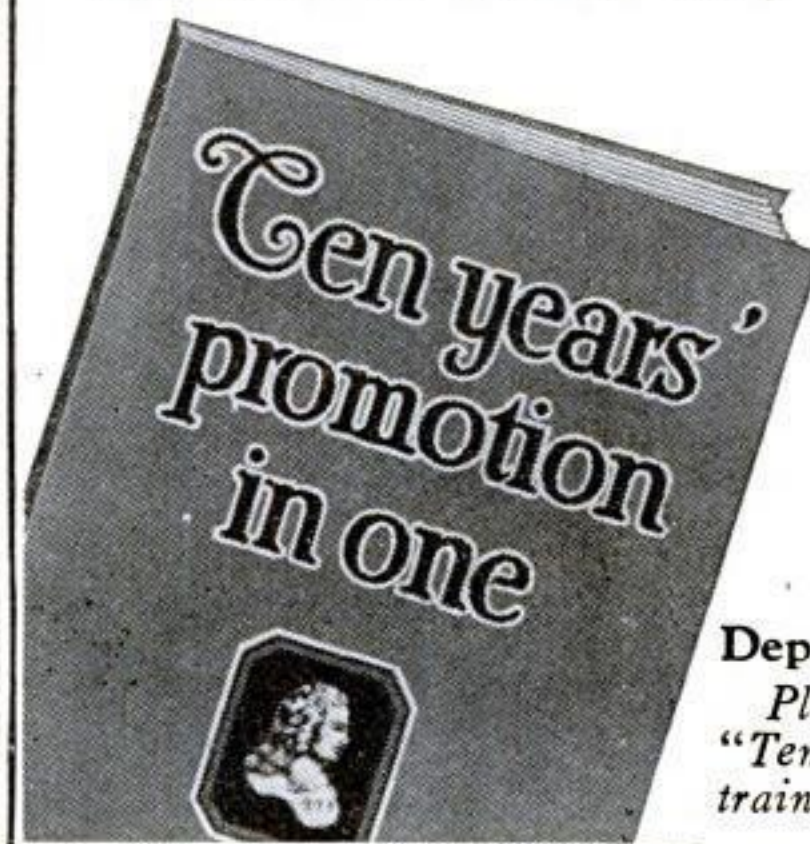
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hard work and learning through day-to-day experience will eventually win you some measure of success. If success is sweet, however, is it not doubly sweet if it comes to you while you are still young enough to enjoy it?

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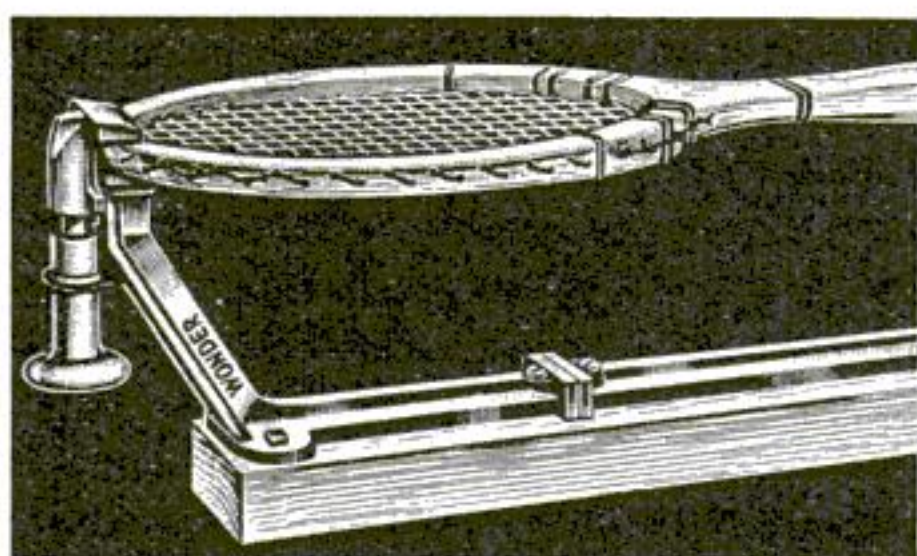
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Secrets of Success

In January of 1921, I bought Hebrew and the Greek grammars—three of each. As fast as I could earn the money, I bought text-books and classics; lexicons, my Hebrew and Greek Bibles, Illiad and Odyssey, Aeneid in Latin, dictionaries, Latin grammars, encyclopedias, the Metamorphoses (abridged) by Ovid, and such texts. Few of my books were new. Some were given to me. Most of them were bought at second-hand stores and home missions. I bought both translations and originals.

Since that time in January, every spare minute has been happily employed in the study of these books. With the help of auxiliary texts, I am a master of the original Scriptures from which the English Bible was translated. I can also translate from the Illiad and the Odyssey, and I am beginning to interpret the Aeneid.

I am still hindered through lack of books in the graduation I long to attain in this original wisdom. My ambition first is to satisfy the lure for enlightenment in these primary ideas of our being and, second, to paint and to write books about classical subjects. I declare with joy—I would not exchange my home-study enlightenment for the Mellon fortune. The Muses are dearer each day.—M. M., Colorado Springs, Colo.

BECOMES WRITER ON POULTRY HUSBANDRY

In October 1912 I started a complete poultry farming course with the School. At the time I was a high school student and without means to buy the course which cost \$75. However, the local agent at Fresno, California (where I lived at the time) said he needed some one to sweep out the office each morning and to oversee a few boys whom he hired to distribute literature on Saturdays.

Glad of the opportunity, I paid for the course with work, and was receiving cash before the school year was over. The course took me fifteen months to complete (without delaying my high school study) and during the balance of my high school terms I earned spending money from my chickens and pigeons.

Later I moved to Southern California and have had various positions in poultry work, including hatchery and sales work with L. E. Leonard Hatchery, Gardena; trapnest work with George England, Inglewood; assistant manager of Fanciers' Exchange, Los Angeles; and foreman of M. H. Gilliams poultry ranch at Hemet, California (4,000 hens).

Based on the poultry course, plus the experience I picked up from work available through knowledge gained in the poultry course, I have written poultry articles for the Sunday farm section of the Los Angeles Times. I also wrote poultry articles for a farm magazine printed by the Los Angeles Examiner for over a year in 1922-23. And for the past three and a half years I have written poultry articles for the farm section of the Riverside Daily Press, and Riverside Enterprise, where my articles are features. Personally, I rate the correspondence course as being a very solid foundation upon which to build—V. O. H., Riverside, Calif.

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Shooting Insurance TO RESTORE WILD GAME

RESTORING American wild life through "shooting insurance," a plan by means of which sportsmen and farmers will coöperate to provide food and shelter for game, is being promoted by the Western Cartridge Company and the Winchester Repeating Arms Company.

Millions of acres of land in the United States, as a result of plowing, drainage, highway construction, and timber operations, have been made unfit for upland game. The needed weeds, brush, and thickets are gone. Recently, in various parts of the country, "game-bird farms" have made their appearance. On unused land, farmers have raised quail and other game birds, charging hunters so much a day or a bird for shooting over the land during the open season. In such cases, however, the farmers took all the risk. When a severe winter or a long drought reduced the harvest of game they lost.

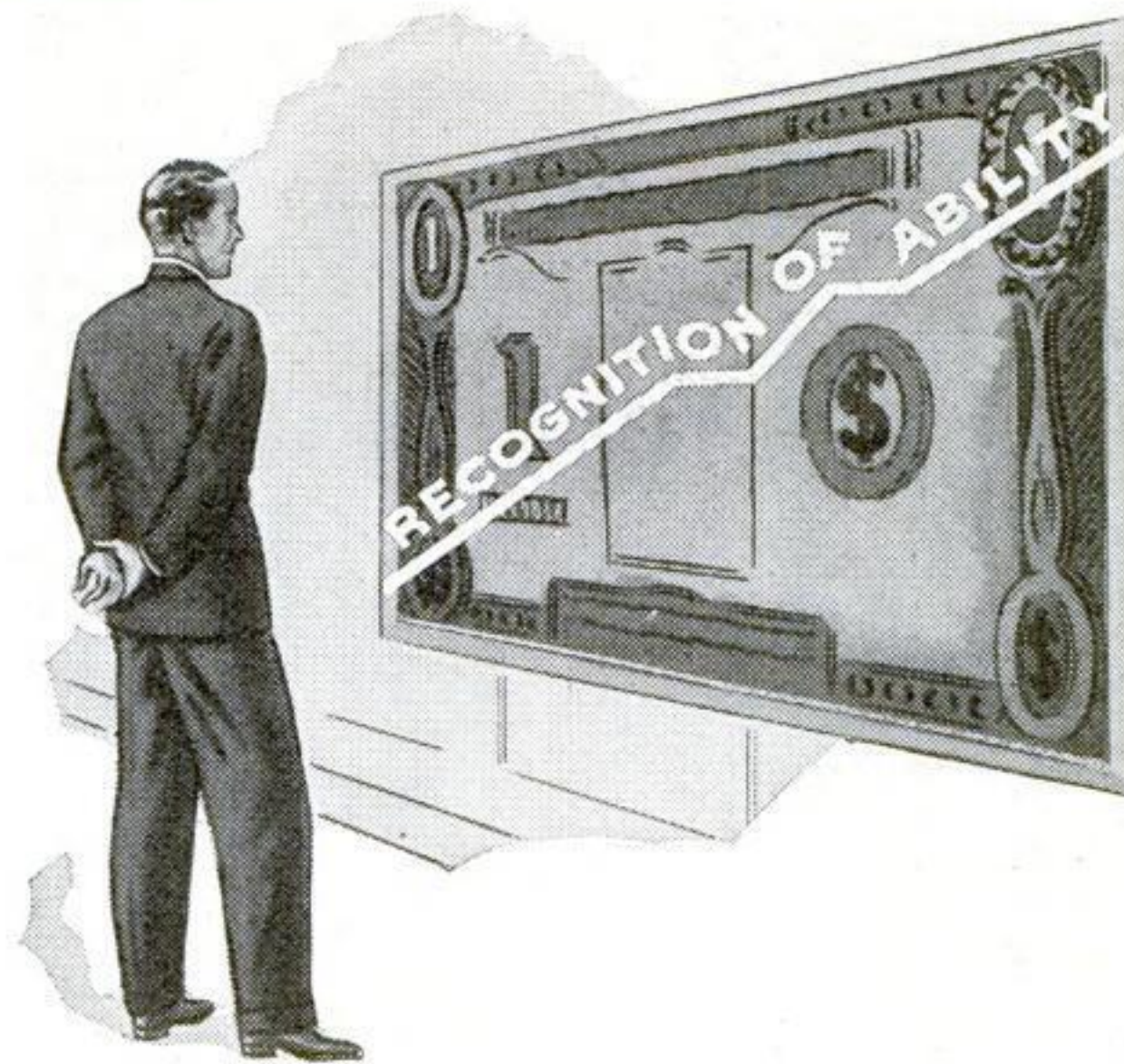
THE unusual feature of the new proposal, known as the Western-Winchester Plan, is to have the sportsman, who benefits most by an increase in wild life, assume the risk instead of the farmer. Just as golfers pay dues to support their golf courses, the sportsmen of a community will contribute to paying the farmer for his labor and for the use of his land. By so doing, they will aid in restoration and at the same time will be taking out insurance, so to speak, against having the sport of shooting die out.

Coöperating farmers will be paid according to the number of acres they devote to raising game and the number and area of the food patches they plant. The sportsmen will pay in proportion to the amount of game they shoot in a season. Basing estimates upon experience at a model farm of the kind in Illinois, the proponents of the plan expect that a day's shooting under such conditions, with a limit bag of quail, will cost about \$3.00.

The plan is applicable to local communities, counties, states, or the entire nation. As a first step, the local group of sportsmen is to "adopt a farm," trying out the scheme in one place. It is expected to take from three to five years to get a selected area well stocked. As wild creatures rarely respect fences, the benefits of such refuges will extend to all the hunters of the community. Coöperation is planned between the different units of the program and Government agencies such as the Soil Conservation Service and the Civilian Conservation Corps.

IN ADDITION to establishing food and cover for upland game, the organized sportsmen are to take an active part in the destruction of predatory animals and birds. The drive will be made against hawks, crows, stray cats, owls, rats, snakes, weasels, foxes, skunks, and mink.

By increasing food and protection for upland game, on the one hand, and by reducing the number of natural enemies, on the other, the new program will attack the problem of our vanishing wild life from two sides at the same time.



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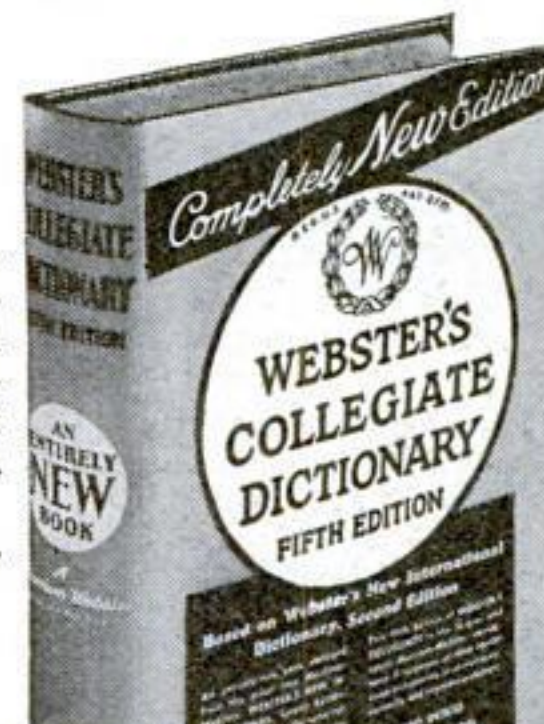
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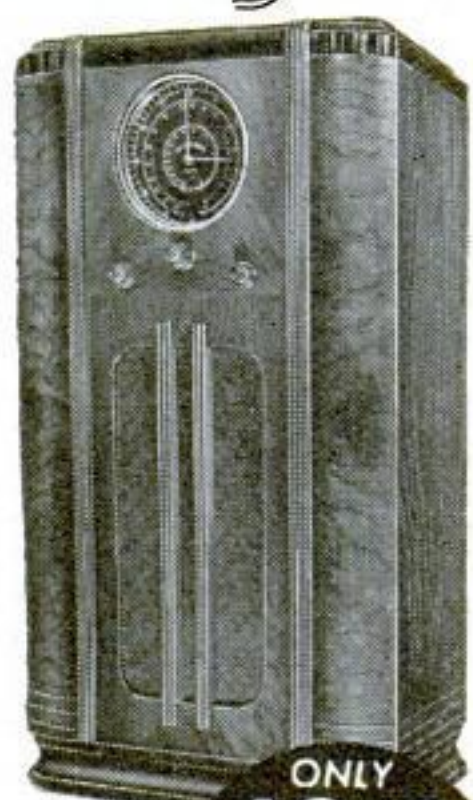
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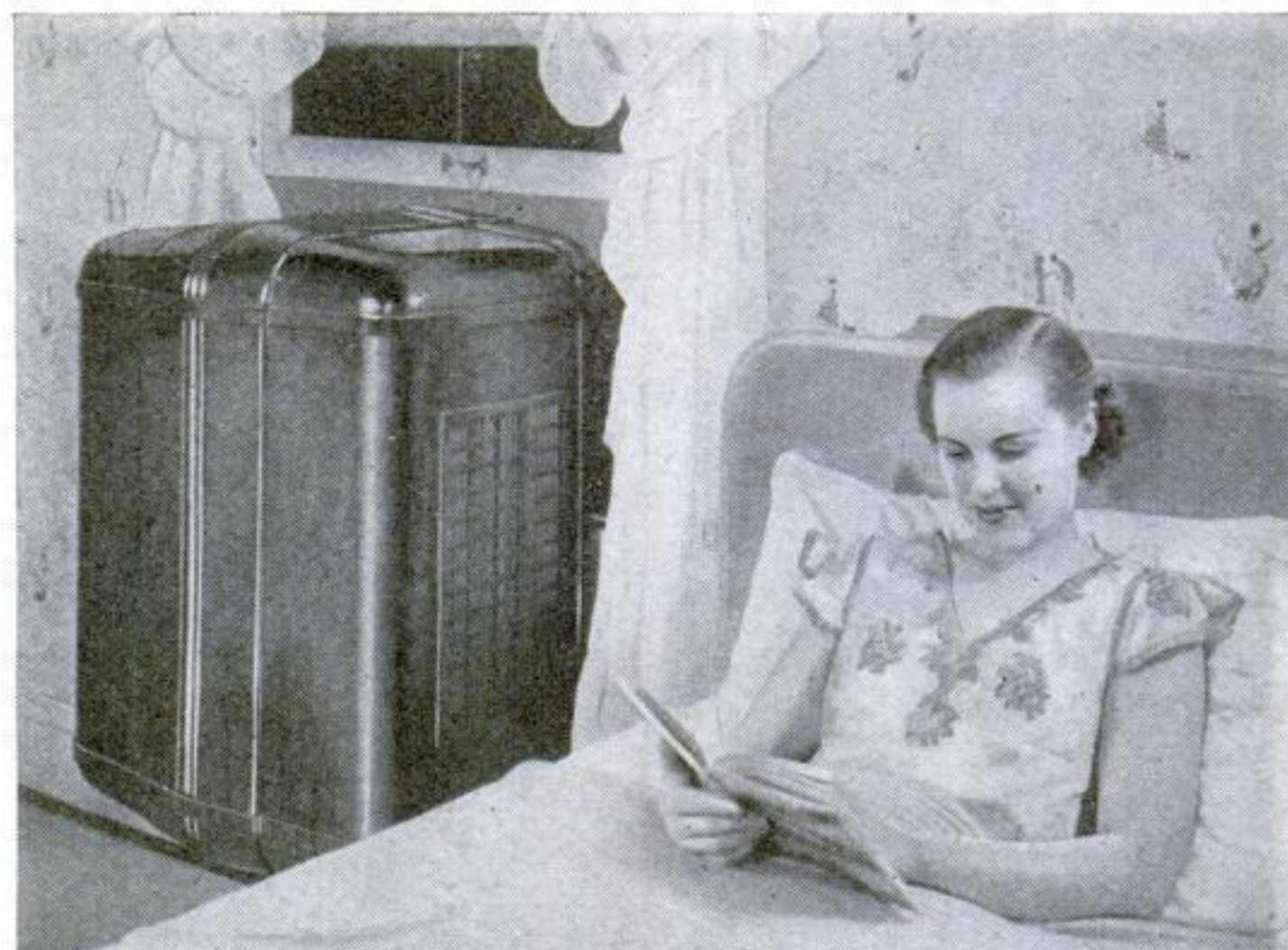
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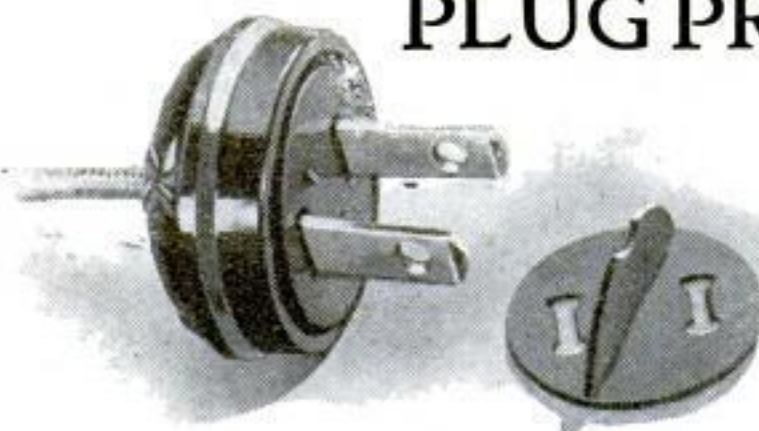
AIR CONDITIONER FITS ON WINDOW SILL

AMONG the latest types of air conditioners now available for small-home use is a combination room cooler and ventilator that can be installed in less than a half hour. To put the unit in operation, it is simply necessary to open the window half way, rest the cabinet on the sill, and plug the power cord into a convenient outlet. In place, the conditioner not only cools and circulates the air, but dehumidifies it as well.



This window-sill unit cools, circulates, and dehumidifies the air

PLUG PREVENTS SHORT CIRCUITS



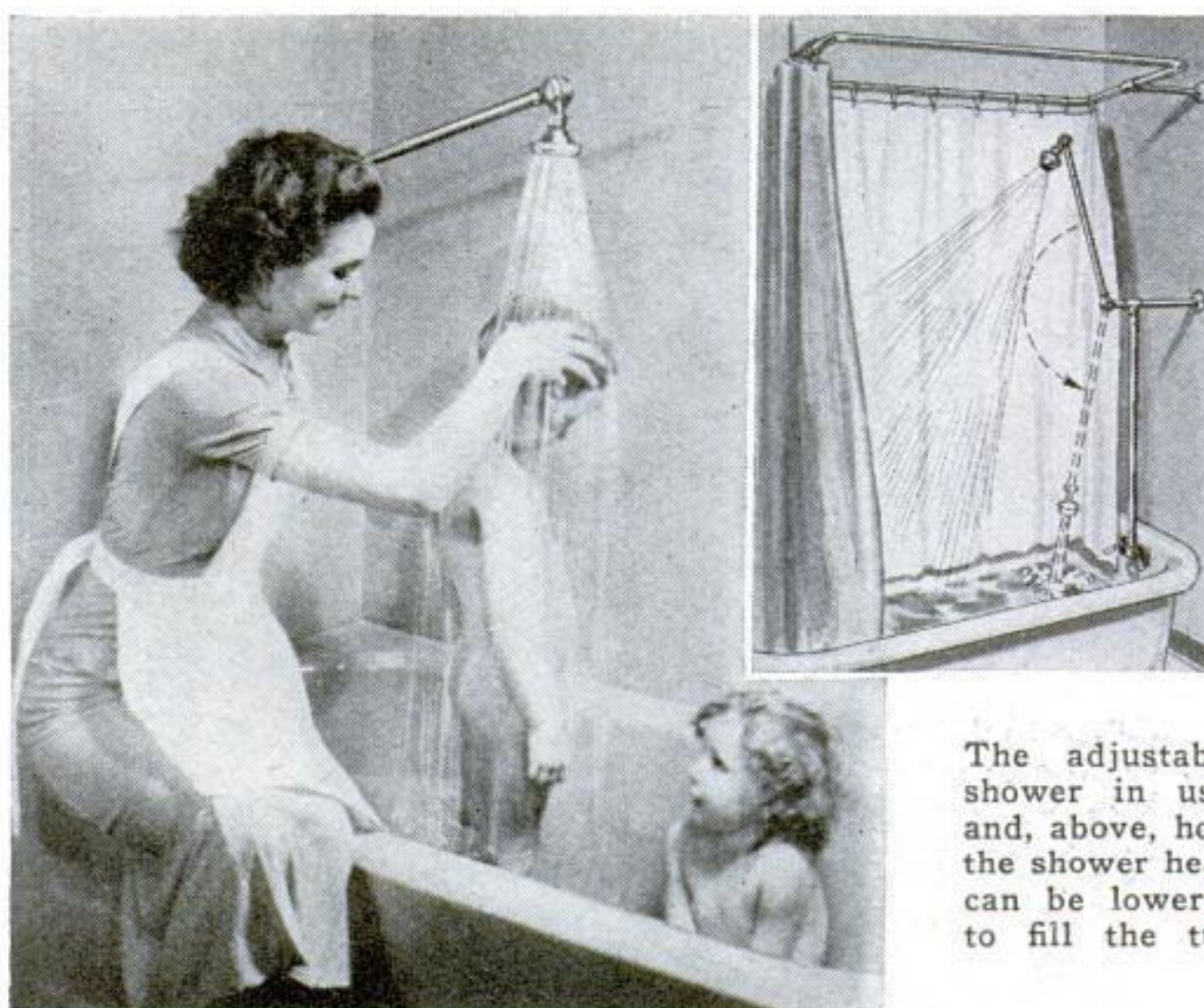
SHORT circuits due to loose terminal connections are prevented with a recently devised appliance plug fitted with a special partitioned cover. A fin, or safety wall, attached at right angles to the conventional fiber cover disk forms two separate compartments within the plug, thus preventing accidental contacts.

DUAL-PURPOSE SHOWER EASILY INSTALLED

DESIGNED so it can be easily installed in existing bath tubs, a new all-purpose fixture serves as a convenient tub filler as well as a shower bath. Adjustable from a

fine spray to a full stream for tub filling, the shower head is mounted on a pivoted arm that can be moved either up or down to provide a shower for the smallest child

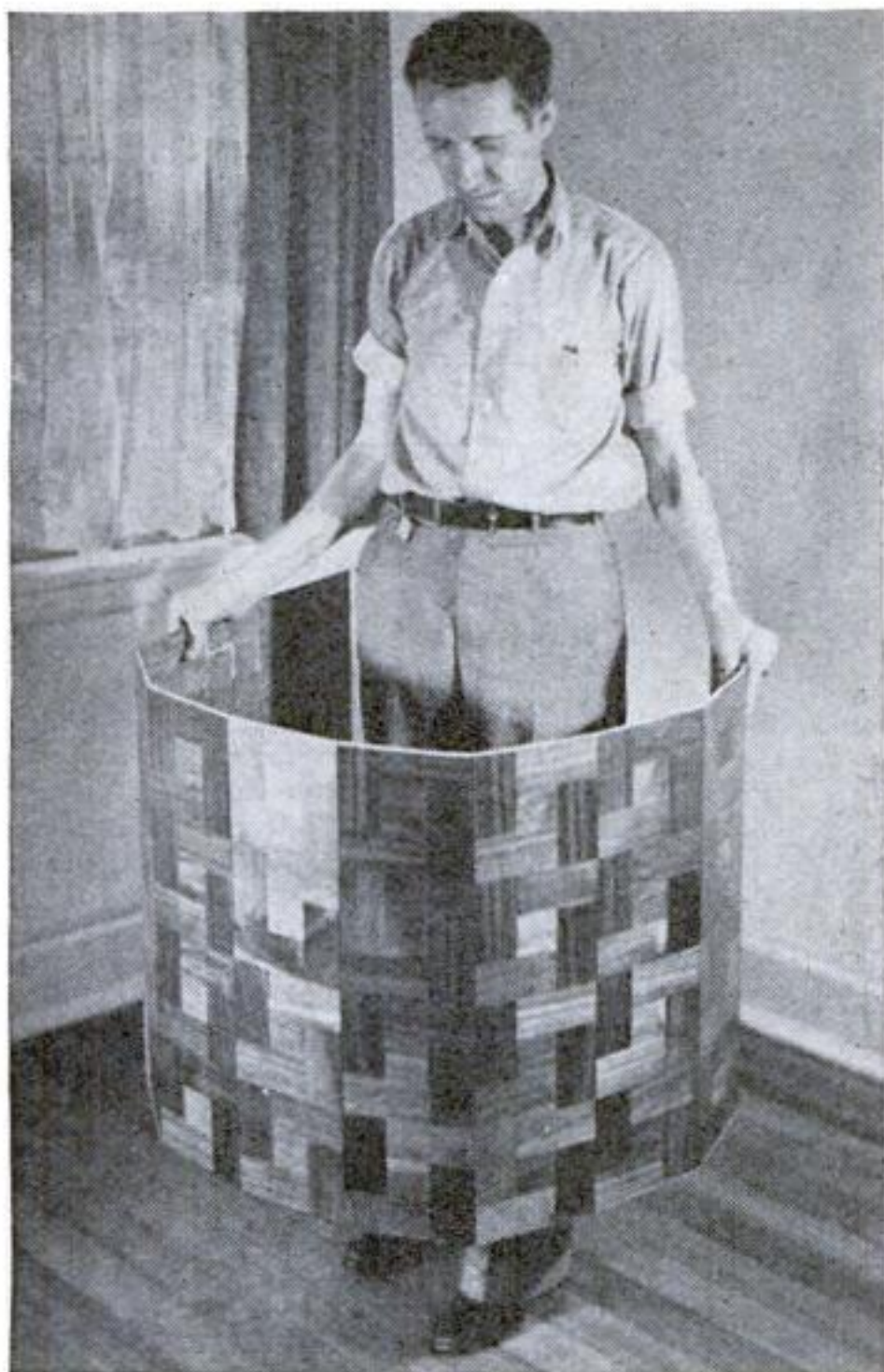
or the tallest man. With the proper adjustment, showers can be taken without wetting the hair. Or, by standing alongside the tub, the hair can be shampooed without wetting the rest of the body. On installations in new homes, the fixture is connected to concealed piping in the wall three feet above the top of the tub. All the advantages of the new shower can be brought to existing bathtubs by removing the old faucets and installing a special set of adapter pipes in their place.



The adjustable shower in use, and, above, how the shower head can be lowered to fill the tub

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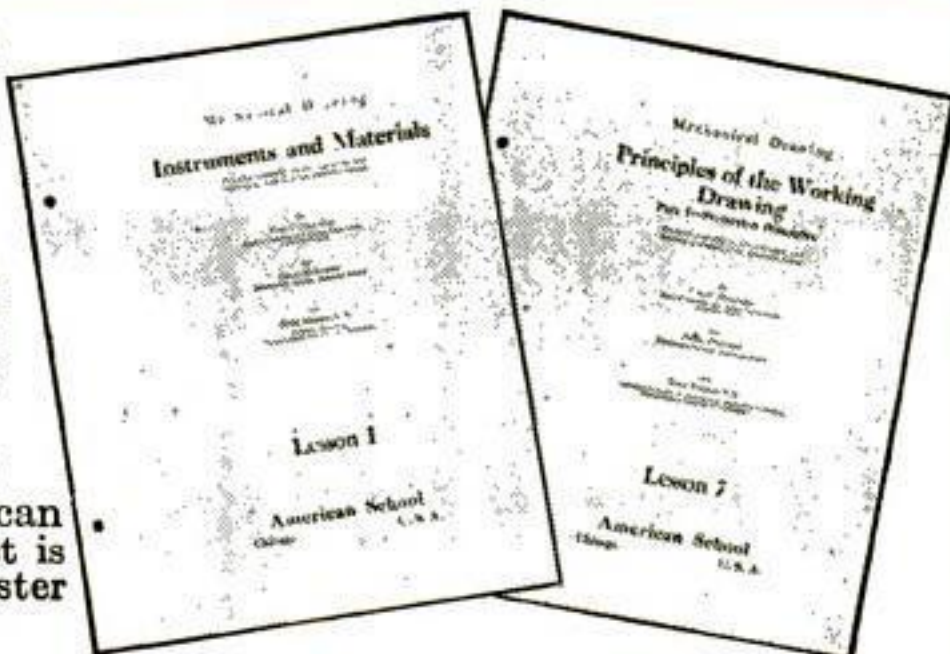
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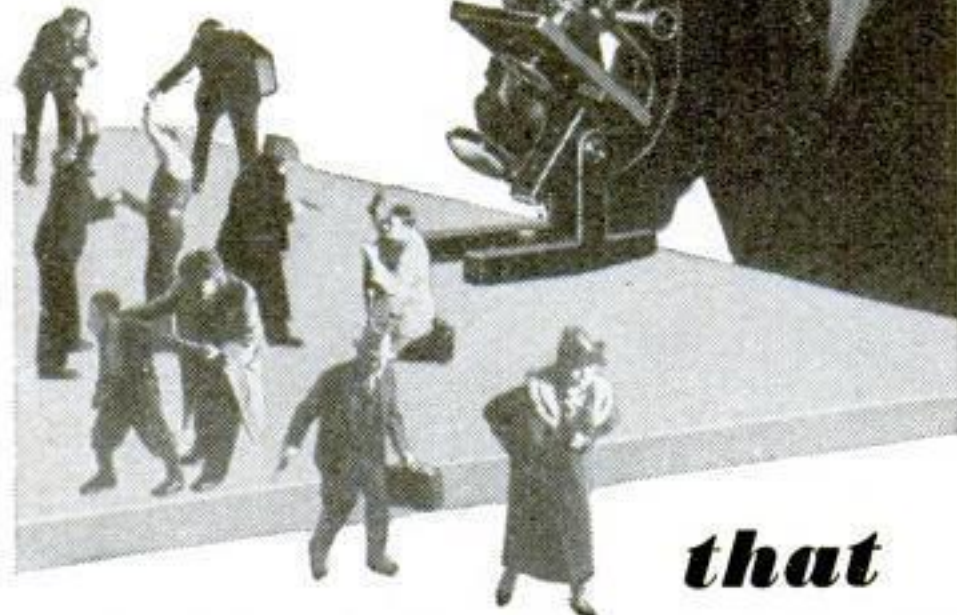
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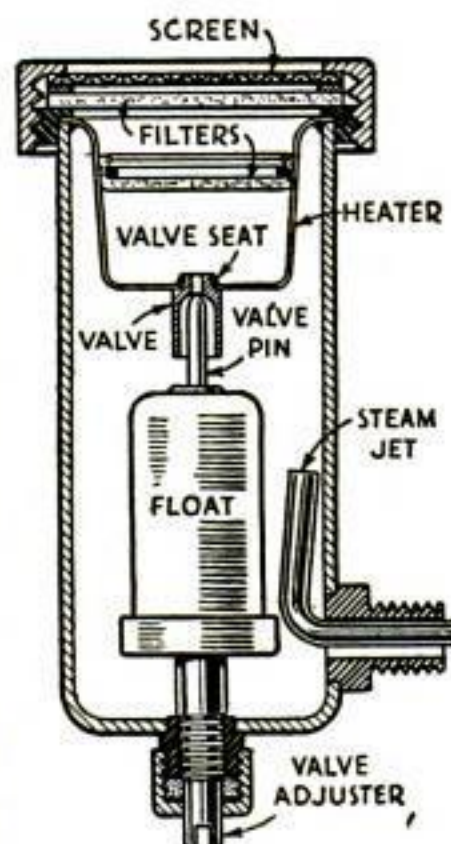
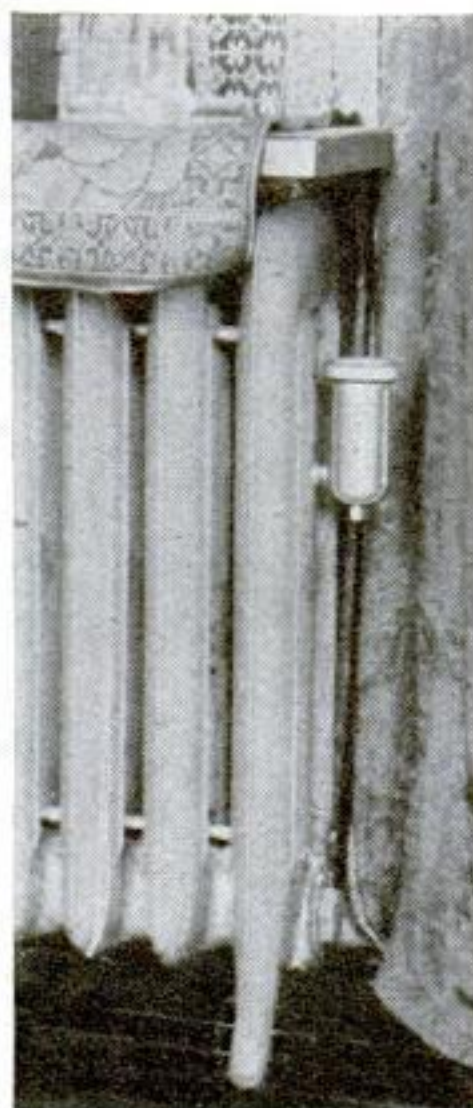
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A cross section of
the humidifier and
how it is installed

room such as an ordinary parlor. The amount of moisture released into the air is easy to regulate by means of an adjusting screw at the base of the humidifier. This can be turned with a coin or a screwdriver to set free any desired amount of water vapor. Filters, made of wool felt, are built into the unit to extract any dirt that may be present, and also to prevent the discharge of any actual water. They are easily replaced by unscrewing the cover of the device. Because it automatically vents the air from the radiator, the humidifier also displaces the conventional air valve.

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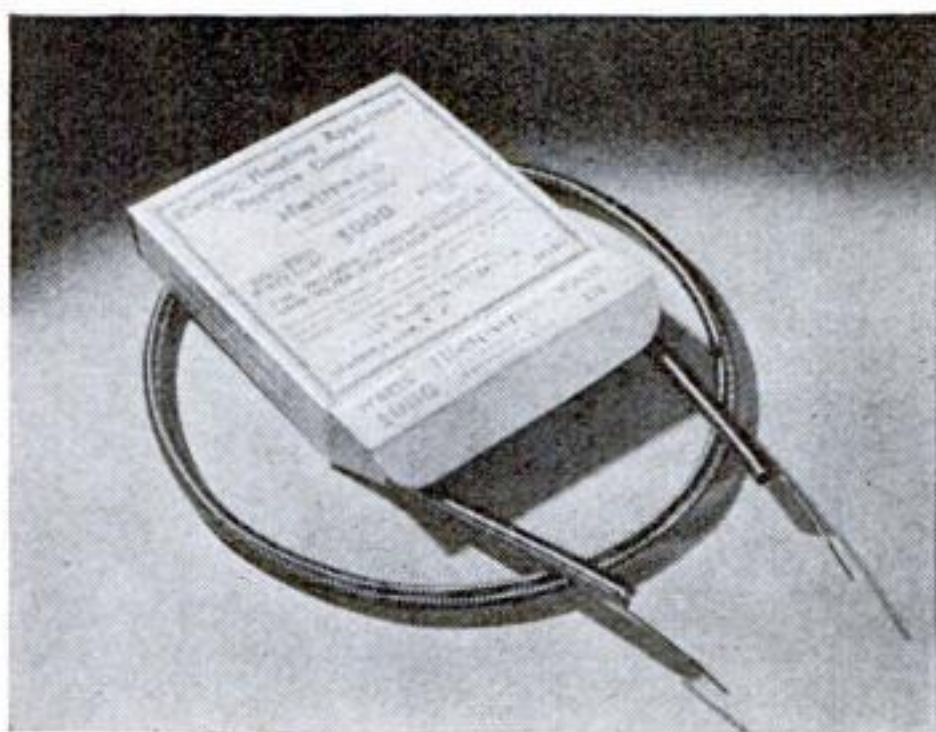


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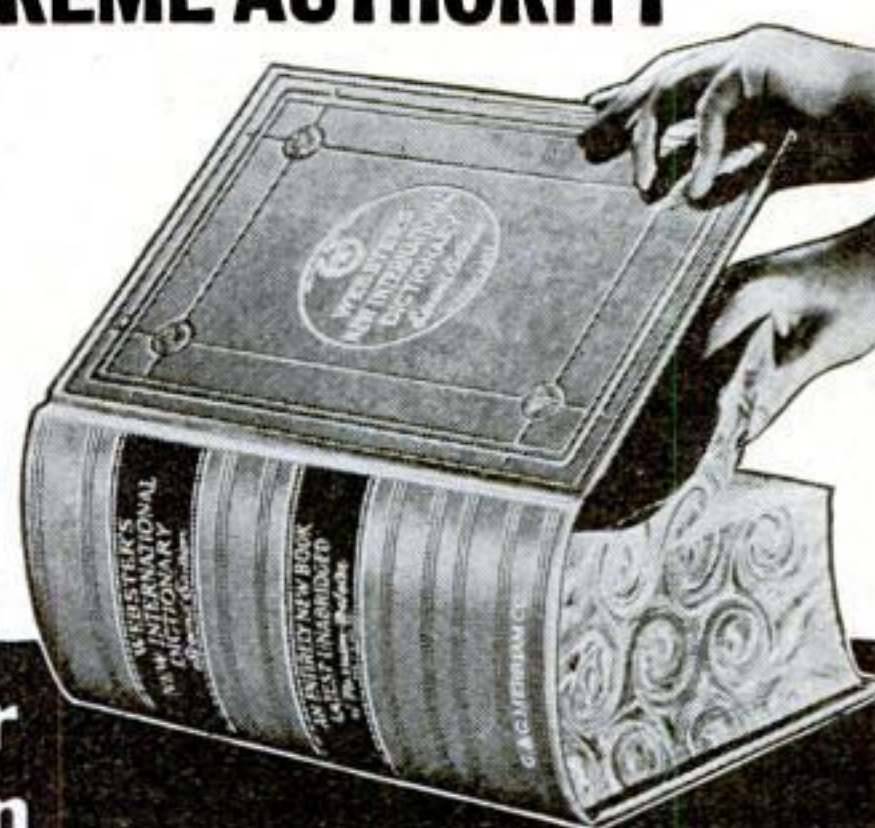
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FROM HOME OWNERS

Q.—I AM planning to repaint my house in the spring. Is there any simple rule by which I can estimate the amount of paint I shall need?—R.W.K., Tulsa, Okla.

A.—THE APPROXIMATE quantity of paint needed to cover the exterior of a house can be roughly estimated by measuring around the outside of the building (in feet), multiplying this figure by the average height, and then dividing by 300. The result will be the number of gallons required for two coats of paint. Do not make any allowance for doors or windows, but if the house has high, broad gables, add one-fourth to the total.

How To Color Celluloid

E.K.T., MILWAUKEE, WIS. To color celluloid, first wash it in soapy water and then rinse thoroughly. Dipping it in a solution of copper acetate will turn it green; to make it blue, dip it in a solution of indigo which has been neutralized by the addition of soda.

Wood Finish Over Paint

J.P.D., KANSAS CITY, KANS. A natural wood finish for floors which have already been painted can be made as follows: paint the *(Continued on page 19)*

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QUESTIONS FROM HOME OWNERS

(Continued from page 18)

floor white, then get some dry powdered umber or sienna from a paint store. Make a paste of the color with vinegar, and, with a rag, rub it on the floor in such a way as to imitate the grain of wood. Finish with two thin coats of good shellac. The appearance will depend mainly upon how well you can imitate wood grain. It is a good idea to practice on an old board beforehand.

Rusted Machine Screws

H.P., KNOXVILLE, TENN. To remove a rusted machine screw first put a little oil on it. Then heat a long iron rod to a red heat and hold it on the screw head for a minute or two. Let the screw cool, adding more oil if what you put on has evaporated. When cold, the screw usually can be removed with ease.

Water Stain on Painted Sill

Q.—WATER dripping from a flower pot has made a circular white stain on our kitchen window sill, which is coated with a light cream paint. How can this stain be removed? Mrs. K.B.L., Akron, Ohio.

A.—PROBABLY the water has removed the color from the paint; the only remedy is to scrape the stained area and repaint.

Frosting a Glass Vase

G.G., SACRAMENTO, CALIF. A glass vase can be frosted by dipping it in ordinary water glass and then immersing it in a concentrated, boiling-hot solution of either epsom salts or ammonium chloride. By adding a water-soluble dye to the water glass, the vase can be tinted at the same time, if color is desired.

Leaks in Water Pipes

R.C.D., PHILADELPHIA, PA. To repair a small leak in a hot or cold-water pipe, scrape off the paint and plug the hole with boiler cement. Cut a strip of leather from an old shoe or chair seat and wrap it around the spot. Then bend a band of sheet metal around the leather, clamping it tightly at the ends with one or more stove bolts.

Cleaning Wringer Rollers

N.A.R., ALBANY, N. Y. A weak solution of ammonia generally will clean the rollers on a laundry wringer. If they are badly stained, try wiping them with a cloth which has been dipped in kerosene. Be sure to wash off the kerosene immediately after it has been applied, since it will dissolve the rubber, as well as the dirt stains, if left on too long.

Old Varnish on Metal

M.P.E., CLEVELAND, OHIO. An old varnish finish on metal can be removed by dipping in equal parts of ammonia and denatured alcohol. If the piece is large, apply the liquid with a soft brush. Keep the surface moist until all the varnish has softened, then wipe it off with a rag.

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(Continued from page 20)



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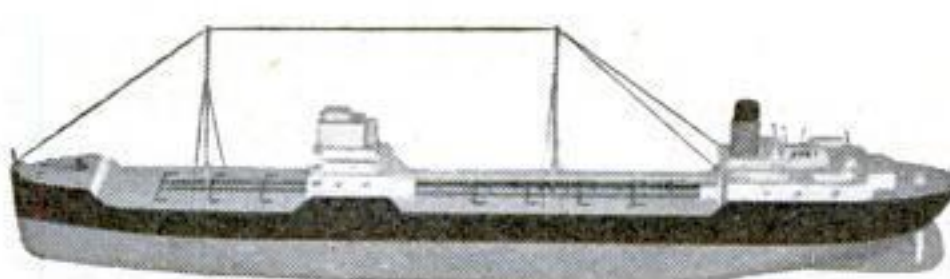
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(Continued on page 22)



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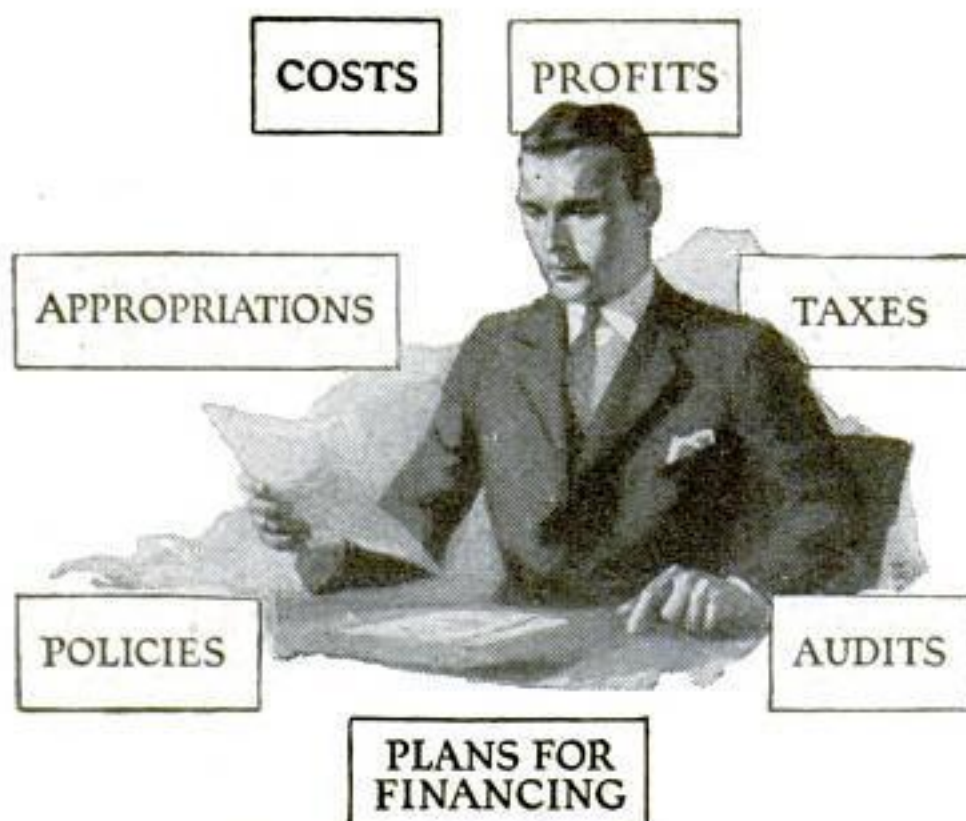
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OUR CONSTRUCTION KITS

(Continued from page 21)



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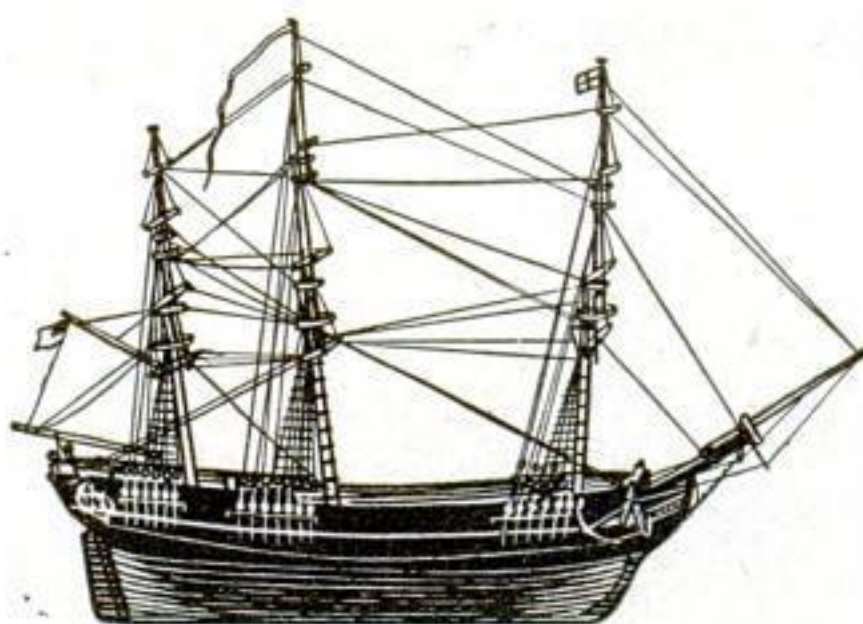
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TESTS FIND SIX COLORS EASIEST TO TELL APART

WHAT half-dozen hues can you distinguish most easily? Needing a six-color system of aviation signal lights, Navy officials recently put the problem up to the U. S. Bureau of Standards. The signals were to be incandescent lamps covered with tinted-glass globes, and their colors must be recognizable 1,500 feet away, even through a light haze. Observers on an outdoor test range attempted to identify the colors of lamps exhibited at a distance by Bureau of Standards experts in 58,000 separate trials. One of the "Christmas-tree" assortments of hues proposed for the signal system—red, orange, yellow, white, green, and blue—proved inferior because of confusion among the first four. The best combination, the tests showed, consisted of red, orange-yellow, white, green, blue, and purple.

SWEDISH PHONE USERS DIAL FOR WEATHER DATA

WITH a spin of the dial, telephone subscribers of Stockholm, Sweden, now may learn what the weather is to be. The number assigned to the unique service sets in motion a specially prepared wax record, supplied by the weather bureau to the central exchange, which announces whether it will be warmer or colder, and whether rainy or fair. Records are changed, if necessary, several times a day. Another dial number automatically dispatches a taxi to the home of the caller. In addition, the telephone users of Stockholm enjoy a time-of-day service similar to the systems that announce the correct time to dialers in a number of American cities.

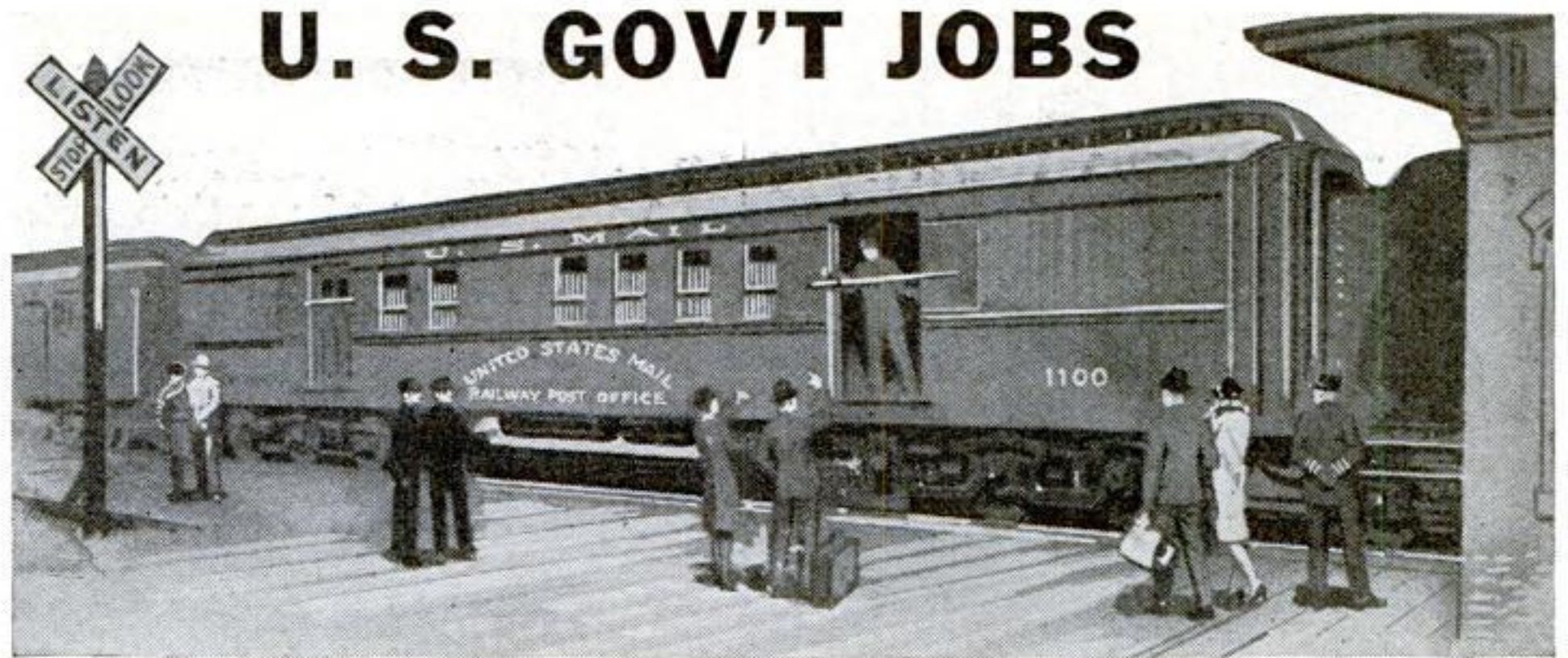
COUNTS DUST PARTICLES IN THE AIR WE BREATHE

EVERY sixty seconds, 900,000,000 dust particles pass through the lungs of the average city dweller! That is the startling fact brought out in experiments recently reported by Dr. Helmut Landsberg, of Pennsylvania State College. He has made 16,000 observations at 160 different places on the earth's surface to compile his data. As many as 90,000,000 of the microscopic dust particles are left behind in the lungs, he reports. Besides man-made dust from factories and homes, the particles in the atmosphere come from volcanic eruptions, wind-blown soil, bacteria, pollen, and the smoke of forest fires.

RUBBER ARTERY SHOWS HOW BLOOD CIRCULATES

MADE of rubber tubing, a fifty-foot artificial artery is being used to teach physiology at Bowdoin College, Brunswick, Me. The huge model was designed by Prof. Noel C. Little to show the complex mechanical problems involved in the circulation system of human body. By modifying conditions, Prof. Little can demonstrate how the pulse waves travel along a normal artery, and how they behave in a different manner when the artery becomes hardened or is affected otherwise by disease.

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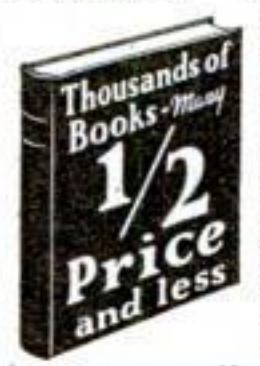
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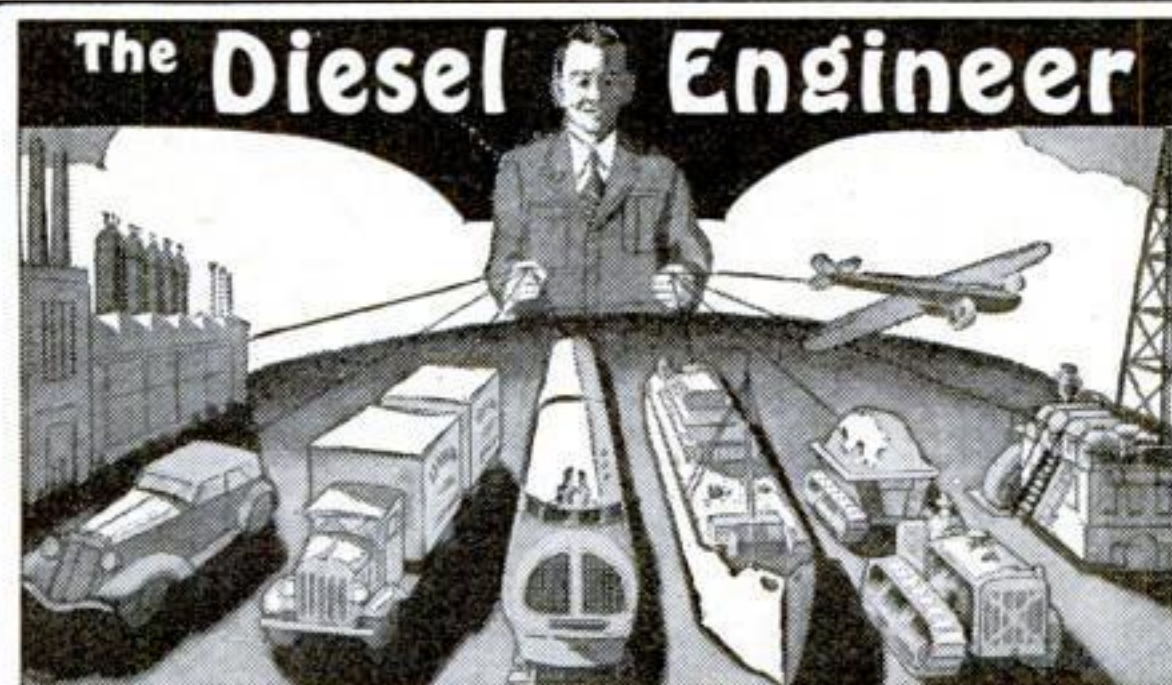
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BURIED INSTRUMENT DETECTS DROUGHT

A POROUS cone of porcelain buried in the soil forms the heart of a new drought-measuring instrument invented by two scientists at Johns Hopkins University, Baltimore, Md. This delicate device reveals the approach of drought even before plants have begun to show signs of distress. Above the porcelain cone extends a tube of mercury against which the soil must pull in order to get moisture from within the cone. This tug of war reveals the soil's power to absorb water, readings on a graduated scale showing the rate of absorption and, consequently, the dryness of the dirt. Tests have shown that it is possible to tell in advance when the wilting point of plants will be reached. The new device is expected to prove valuable in greenhouses and on irrigated land where it will give scientific data on the amount of moisture that is needed by the plants being grown.

LEFT FOOT FOUND TO BE COLDER THAN RIGHT

ALTHOUGH the right side of your body is cooler than your left, your right foot and hand are warmer than your left ones! That paradoxical fact was brought out by recent experiments at the Worcester State Hospital, Worcester, Mass. Scientists at the institution were making tests with a very accurate skin thermometer to see if the slight differences in temperature on the two sides of the body might be useful in diagnosing mental diseases. Testing forty subjects, they discover that in all of them the right feet and hands were a little warmer than the corresponding members on the left side. Individuals vary considerably from each other in the temperature differences between the two sides of the body. However, the difference in any one person appears, from the tests, to remain fairly constant.

RAILROAD DINERS CHECK OUR EATING HABITS

WHAT America likes to eat is revealed in a recent report to the Association of American Railroads, tabulating the 25,000,000 meals that the country's railway dining cars serve annually. Out of every 100 diners, the dining-car steward knows from these figures that thirty-five will order roast beef. The rest will ask for chicken, fish, chops, and steak, in the order named. Apple pie ranks first among all the dishes served for dessert. Eighty-five of the 100 diners will conclude their meal with coffee, and fifteen with tea.

MAGNETS SEPARATE SEEDS

SEEDS of valuable plants are separated from those of weeds by magnetism, in a process devised by a Hungarian inventor. To eliminate unwanted plantain seeds intermingled with clover seed, for example, the batch is dusted with a mixture of magnesium or calcium chloride, calcium oxide, and iron powder. The iron-bearing preparation adheres only to the plantain seeds, which may then be extracted with magnets.

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PIPES RIVAL RAILROADS AMONG CARRIER SYSTEMS

PIPE LINES in North America now rank next to railroads as transportation systems. In the total loads carried, expressed in ton miles, railroads stand first with an annual total of 500,000,000,000, while pipe lines come a close second with 400,000,000,000. Motor vehicles, holding third place, lag far behind with only 34,000,000,000 ton miles to their credit.

Including Mexico, Canada, and the United States, the North American continent holds 211,000 miles of water pipes, 312,000 miles of artificial-gas pipes, 425,000 miles of sewage pipes, and 100,000 miles of petroleum-transmission lines. In addition, natural gas travels 65,000 miles through pipes from the fields to points of consumption.

The transmission of fluids through pipes and aqueducts is one of the oldest of technical arts, and the ancient Chinese piped natural gas in bamboo poles.

EXPERIMENTS REVEAL MIGRATIONS OF CRABS

CRABS, as well as bluebirds and robins, migrate south in the fall and north in the spring, tests made by Prof. R. V. Truitt, of the University of Maryland, at Baltimore, have indicated. This scientist fastened return-address tags to 10,000 adult blue crabs, carrying on his experiments along the Atlantic coast from New Jersey to North Carolina. About 1,100 of the marked shellfish were later captured by fishermen and returned to him with reports on where they were caught. This data gave interesting information about the wandering of the crabs. Another curious, hitherto-unknown fact about blue crabs was brought out by the investigation. In their old age, the females and the males seem to seek different places to die, the females going far out to sea and the males congregating in deep spots along the shore.

VALUABLE BOOKS FREE TO INVENTORS AND OTHER MEN WITH IDEAS

THIS BOOK Tells How To Protect an Invention

TELLS you exactly how the Patent Laws protect you. Why you need a Patent at all. Explains simple but important steps to take *at once* without cost to help establish your claim to your invention. Explains what kind of sketch, drawing or model is needed, the preliminary search, how Patent papers are prepared, assignments in return for financial assistance, etc. Also illustrates many interesting inventions, shows you 115 different mechanical movements that inventors have used in working out ideas, and much more. Inventors the world over have welcomed this book. We gladly send it with our compliments to any serious, interested man.



What is an Invention?

Many people have the impression that an invention must be something radically new or complex. Nothing is farther from the truth. Most successful inventions of today are improvements on devices which have already been thought of before and many of which have been on the market for years. Whether your invention, or your idea for one, is something radically new or merely a sensible improvement on an existing article does not matter. If it will save time, save labor, make money or give pleasure, you should at least see about the possibility of protecting it.

Suggestions on WHEN and HOW to Sell an INVENTION

THIS BOOK Tells How to Go About Selling an Invention

Tells you how in an inexpensive manner you can bring your invention to the attention of prospective buyers. Suggests the proper time to take such step. Outlines methods other inventors have used successfully in selling and marketing. Remember, an invention isn't enough. A Patent isn't enough. You must also know how to cash in. This book deals with that subject. Also sent to you free and without slightest obligation. Mailed the same day we hear from you.

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For 37 years—more than a third of a century—it has been our business to help inventors. We have represented thousands of them from all over the world in their dealings with the United States Patent Office. We answer questions. We study each device to bring out its best patentable possibilities. Also, we frequently advise inventors against going ahead with inventions which could not possibly have been protected. By carefully developed methods, we try to keep expense at a minimum, and arrange deferred payments when needed. The booklets shown above may be the means of saving you time, trouble, expense and even later disappointment. They are yours for the asking. Write us today.

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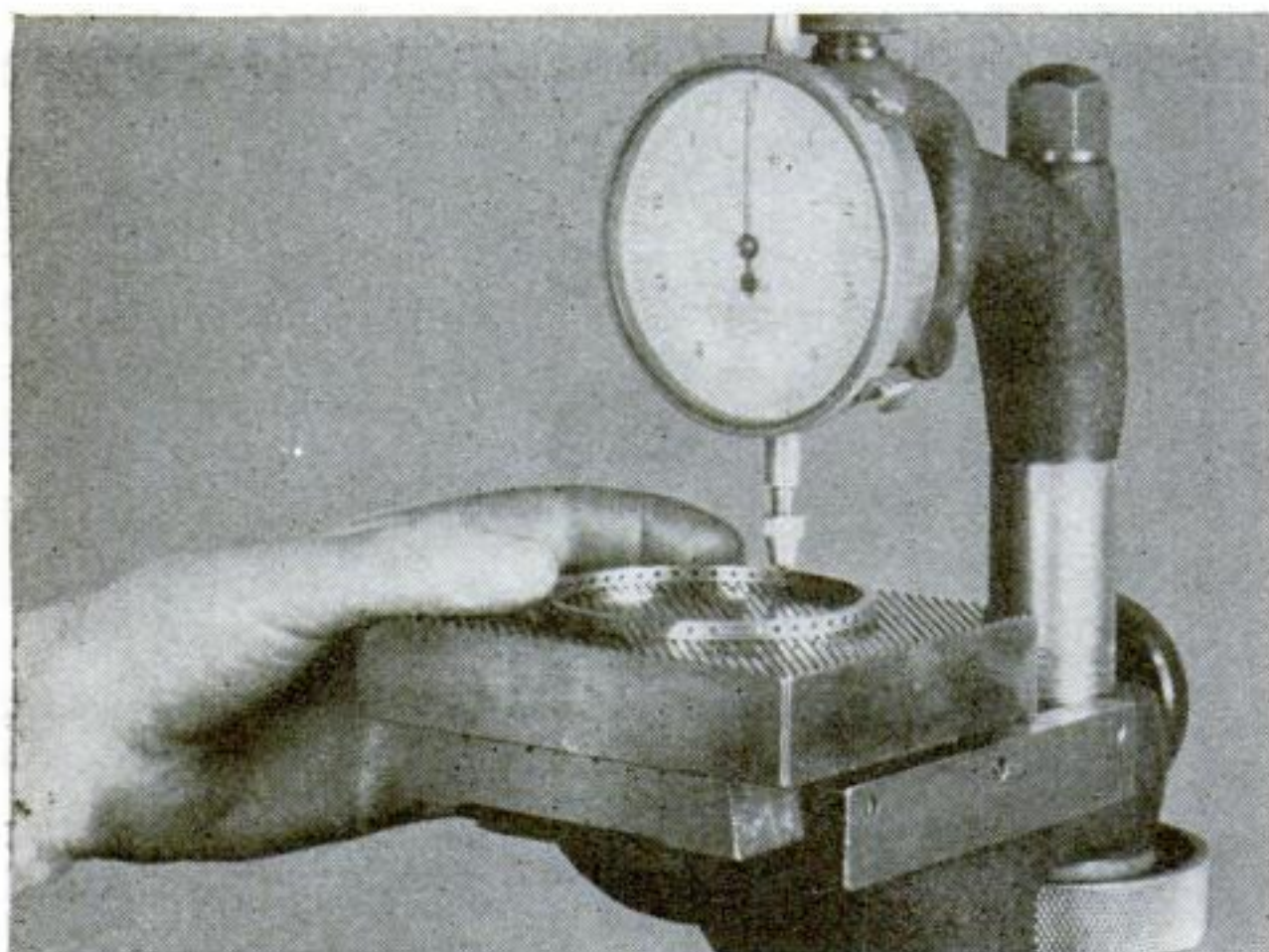
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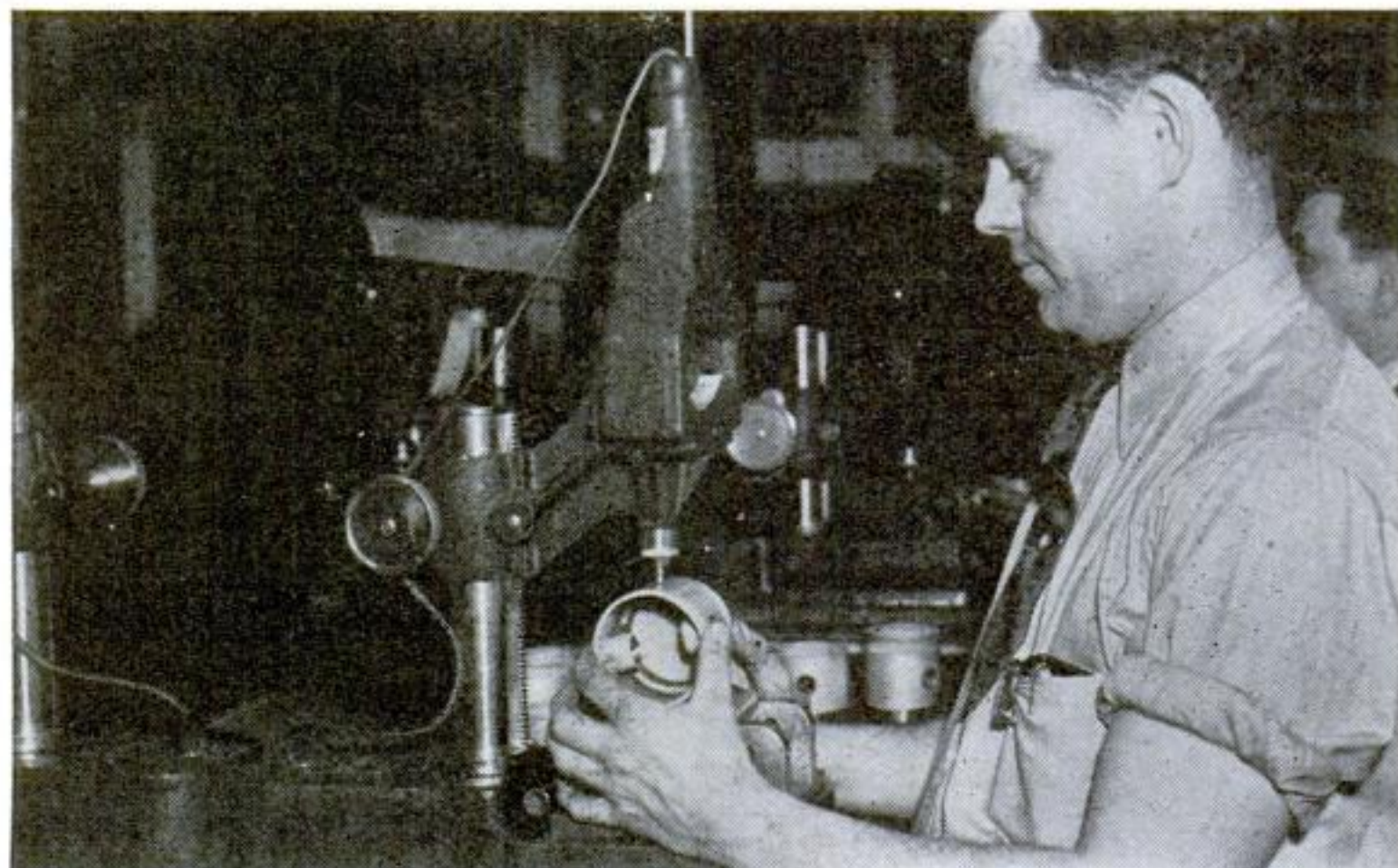
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*Mail this to
Washington, D.C.
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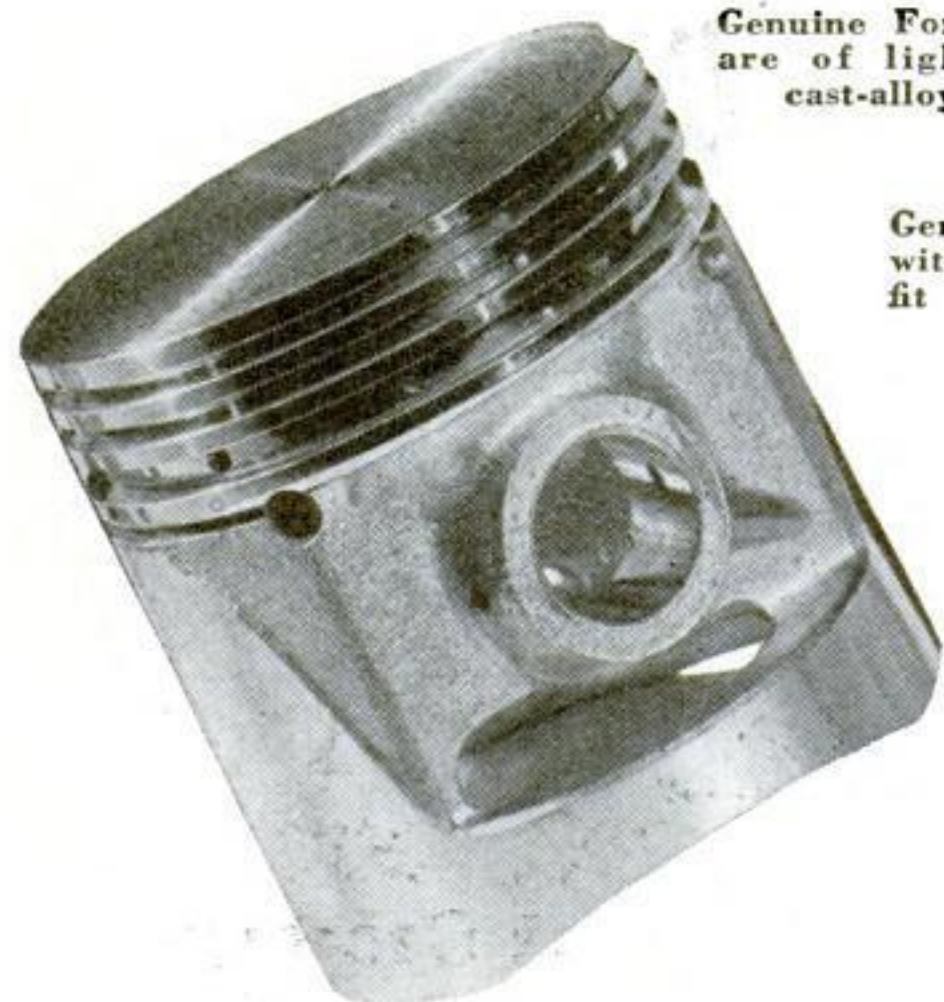
Checking piston-ring widths on extremely accurate dial gage.



Inspecting Ford Pistons for accurate diameter and roundness on quick-reading amplifying type of gage.



Genuine Ford Piston Rings insure a perfect fit in cylinder bores.

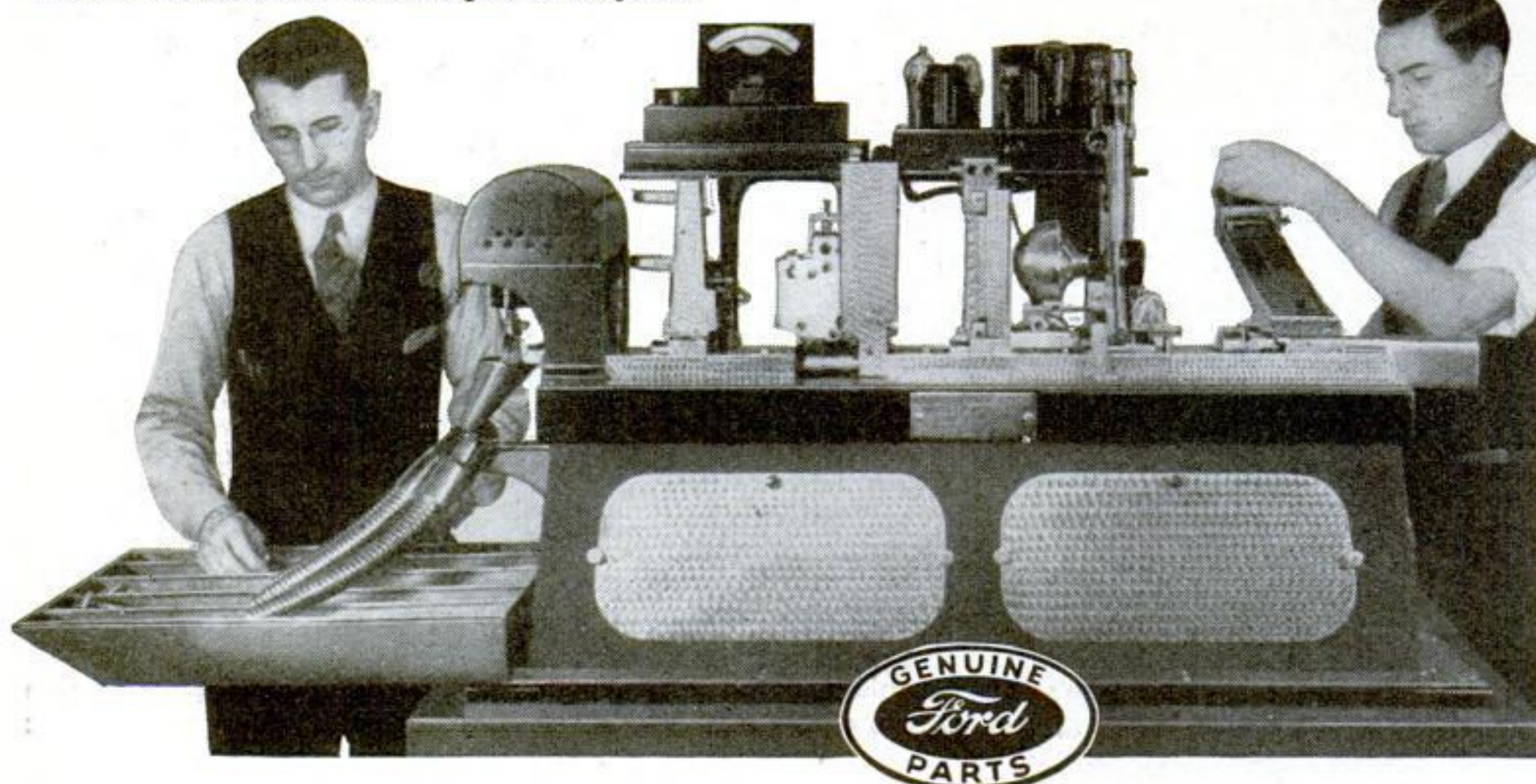


Genuine Ford Pistons are of light-weight cast-alloy steel.

Genuine Ford Piston Pins withstand hard use and fit accurately in piston-pin holes.



This machine automatically inspects Genuine Ford Piston Pins and sorts them with the utmost precision and accuracy into three groups that vary in diameters only one ten-thousandth of an inch. Over-size and under-size pins are rejected.



WHAT MAKES GENUINE FORD PARTS "GENUINE"?

FORD precision manufacturing, materials that must meet Ford requirements in quality, Ford rigid tests and inspections—the standards of a manufacturer who is genuinely interested in the performance and economy of his cars over the years . . . these make Genuine Ford Parts "Genuine."

Thirty-six kinds of steel, for example, are necessary to fulfil the many exacting requirements in the making of Genuine Ford Parts. And as to precision manufacturing—consider Genuine Ford Pistons, Piston Rings and Piston Pins, which are typical.

In manufacturing Genuine Ford Pistons, the diameter is held to a limit of variation of two-thousandths of an inch. Ring-groove widths are held to one-thousandth of an inch. Piston-pin holes must not vary more than three ten-thousandths of an inch (.0003")—one-tenth the thickness of a human hair. And Genuine Ford Piston Rings are held within limits of five ten-thousandths of an inch. That's the kind of

accuracy you want when you buy parts for your Ford V-8. It's the kind you will get if you buy from the Ford dealer or the garage that displays the sign "Genuine Ford Parts."

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Please send me a FREE copy of your booklet, "Reasons Why It Pays to Use Genuine Ford Parts."

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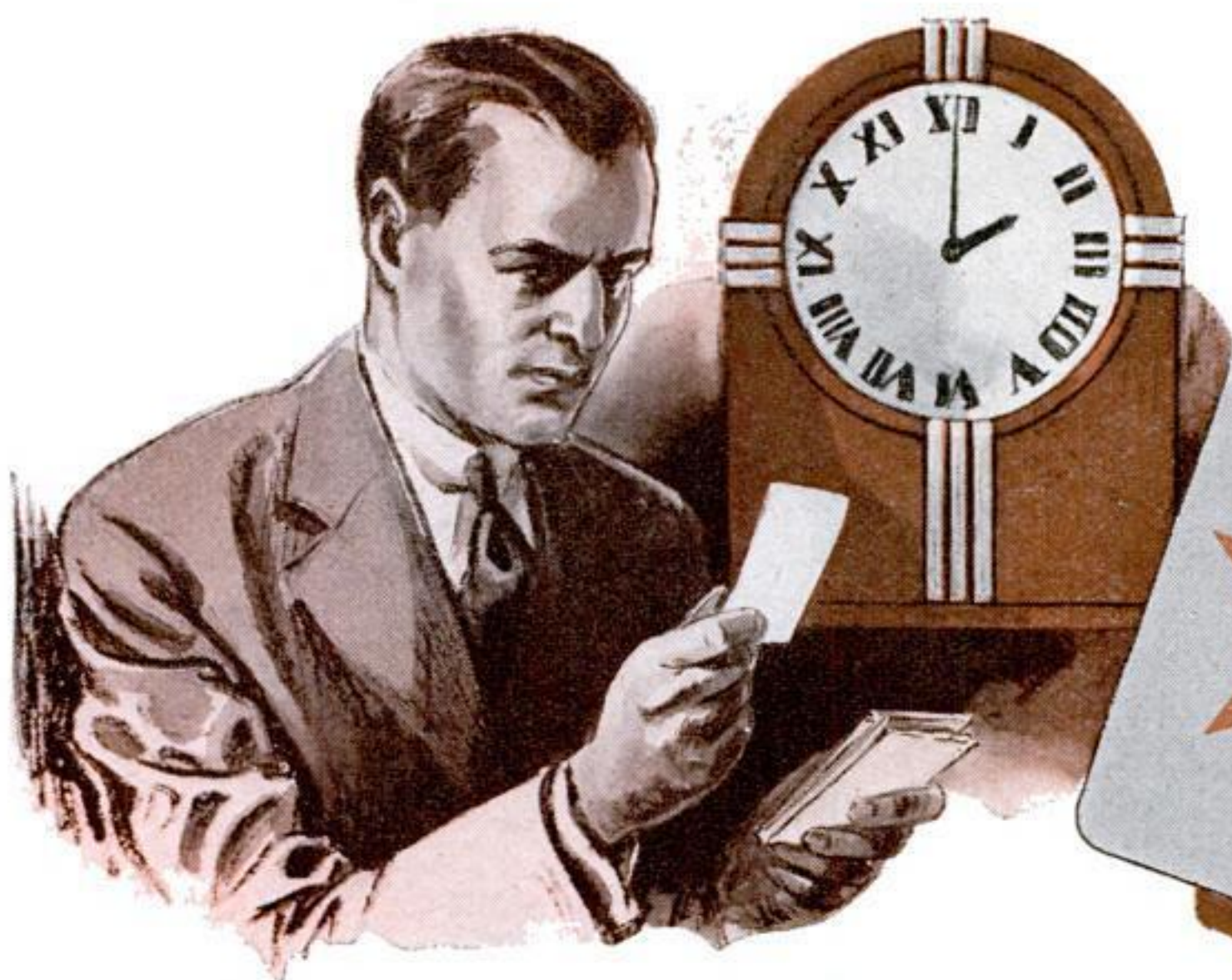
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RAYMOND J. BROWN, Editor

*Amazing Tests Throw New
Light on Telepathy*

By
EDWIN TEALE



Can We Read Each Other's Minds?

IT WAS four o'clock in the morning when a friend of mine awoke from a troubled sleep. He had dreamed that his son, away at college, had broken his ankle in football scrimmage. Soon he fell asleep again, and thought little more of the dream until two days later. Then he received a letter from the boy, saying that he had sprained his ankle. Now comes the queerest twist in the story: The following day, a second letter arrived. The ankle had been X-rayed. It was not sprained, but fractured!

Not long ago, dispatches from Hawaii told of an equally puzzling occurrence. One night, a Territorial forester, Leslie W. Bryan, dreamed he saw a soldier, ragged and dirty, wandering in a desolate spot on the flanks of the volcano, Mauna Loa. Searching parties had been combing the woods for nearly a week looking for a lost private, Edward Deal. The next morning, Bryan tramped up the side of the mountain, found the soldier exactly where he had seen him in his dream, and saved his life.

How do you explain such occurrences? Are they merely the result of chance? Are they simply the products of human credulity and of superstition? Are they out-

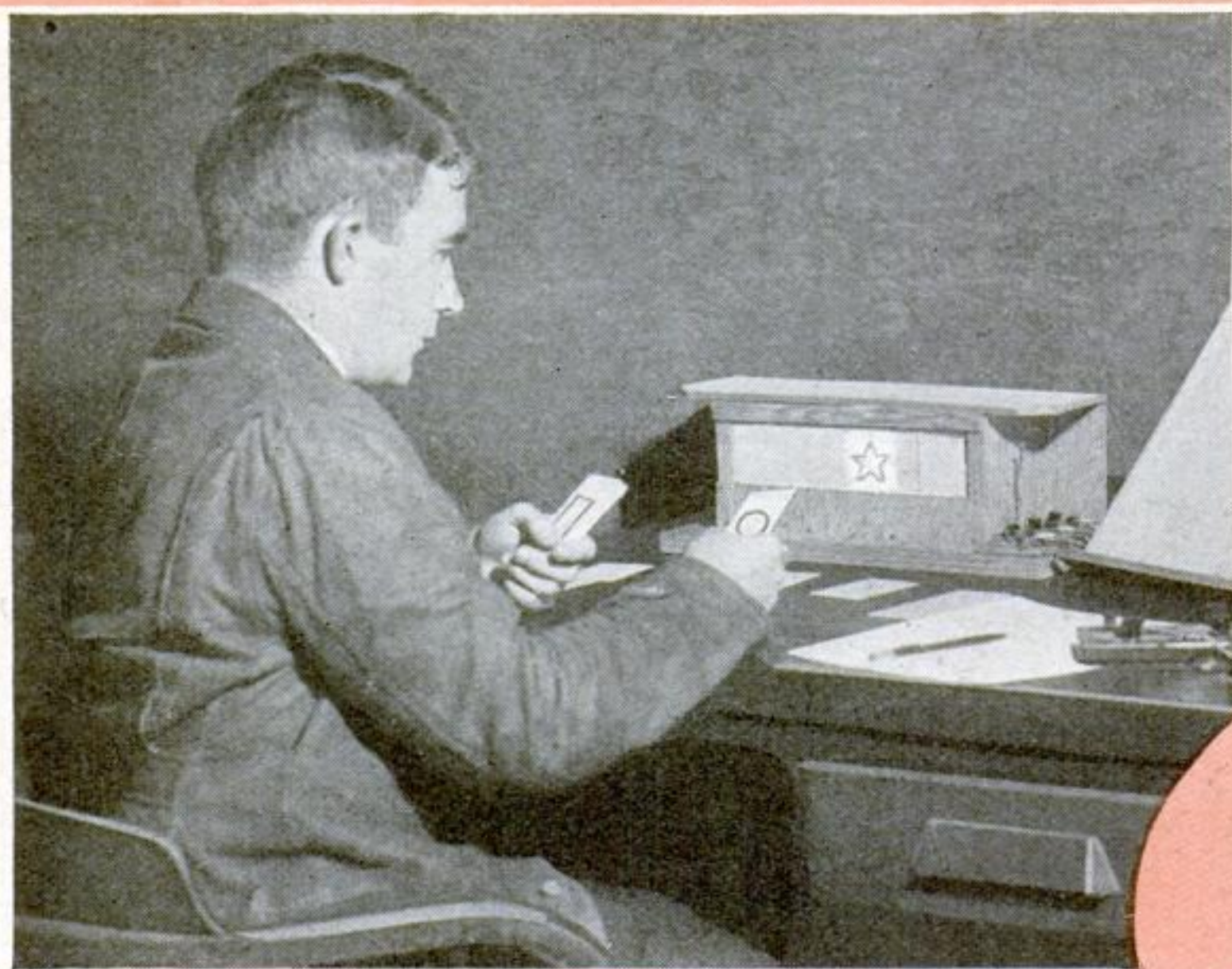
right hoaxes and frauds? Or are they evidences of some unexplored region of the mind which holds vast possibilities for the future?

In all parts of the world, scientists are debating these questions. Workers in widely scattered laboratories are concentrating upon new tests for telepathy or the transference of thought or emotion from mind to mind without the aid of the five senses. As a result, recent months have seen exciting developments in this strange realm of research.

Most of us have had puzzling experiences we can't explain. We have had the fleeting impression that something which is happening at the moment has happened before. We have found ourselves thinking of some-



An attempt at transcontinental telepathy. While an experimenter at Duke University, in North Carolina, gazed at cards chosen at random from a pack, a subject in California recorded which of five symbols he thought they bore



A VARIATION OF THE TEST. Here a psychologist is looking intently at a card he has chosen. The subject, seated in another room, presses a telegraph key corresponding to the one of the five symbols he thinks is on the card, using the keyboard seen at the right. This lights up a panel bearing the symbol, and the "call" is then recorded



one we have not seen for months or years, and then have met him shortly afterwards. Frequently, applications for patents on the same invention come in almost simultaneously. There are times when ideas seem to be "in the air." Luther Burbank's mother once awoke with the conviction that a distant neighbor, who had not even been ill, had died during the night. A few hours later, news reached the Burbank home that the neighbor *had* died the night before. Almost every family has some recollection of the kind. Science is vastly interested in knowing whether such occurrences are caprices of chance or are based on solid laws of psychology.

More than half a century ago, Dr. F. W. H. Myers, president of the Society for Psychical Research, in London, coined the word telepathy. Ever since, psychologists have been trying to prove or disprove the existence of the phenomena it describes. The earliest recorded systematic experiments of this kind were made by an English clergyman, Rev. P. H. Newnham, and his wife. Identified with later tests are such famous scientists as Sir Oliver Lodge, the British physicist; William James, American psychologist; Sir William Crookes, inventor of the Crookes tube; and Alexis Carrel, American winner of the Nobel Prize for Medicine. Crookes, who originated the idea of "brain waves," (P.S. M., May '36, p. 11.) believed that these infinitesimal pulsations of electricity offer a key to the mystery of telepathy.

One "lone wolf" experimenter, J. W. Dunne, a pioneer British airplane designer, slept for years with a notebook under his pillow. As soon as he awoke each morning, he would jot down every dream he could remember. Later, he published the results of his studies in a fascinating volume called "An Experiment in Time." In half a dozen instances, events that he dreamed about were reported in the news as actual happenings the next day or shortly thereafter.

Thus, Dunne "witnessed" a great fire

in Paris, 250 miles away; he "saw" the terrible volcanic explosion on the island of Martinique; he was "present" when a lost Cape-to-Cairo expedition reached Khartoum, in Africa. One explanation that came to his mind was that he might be in telepathic communication with some journalist writing up the events in Fleet Street, London's "Newspaper Row."

In almost any library, you can run across volumes filled with similar experiences, bizarre and mystifying. But, objects the skeptic, what do they prove? The one dream or premonition that comes true is featured in the headlines; the thousands that do not are never heard of. Take, for instance, the case of the Spanish woman who dreamed that the number she held in a lottery would win the prize. It did. Newspapers all over the world carried the story. Later, a scientist investigated and found that nearly 100 other ticket holders in the same lottery also had dreamed that *their* numbers would carry off the prize! It is the batting average, the long-range statistics, that tell the story in scientific research. To obtain evidence of value, the misses as well as the hits must be recorded.

It is this that recent experimenters have sought to do. Dr. J. E. Coover, at Leland Stanford University in California; Dr. Gardner Murphy, of Columbia University in New York; Dr. G. W. Estabrooks, of Harvard

University in Massachusetts, and Dr. Joseph B. Rhine, of Duke University in North Carolina, among others, have been piling up statistics of the kind.

Not infrequently, these tests have seen-sawed between a positive and a negative answer to the question of the existence of telepathy. One of the first apparently shattered a common belief.

Dr. Coover picked ten students who were certain that they could tell when anyone stared at them from behind. One at a time, he placed them in the laboratory with their backs to him and at a given signal had them note down whether they thought they were being looked at or not. Tossing dice to determine whether he would stare at the subjects, he gave each student 100 trials. The results for the 1,000 tests showed the answers were rarely correct, and

there is little to substantiate the common belief that we can "feel" the stares of others.

During researches at Harvard, Dr. Estabrooks worked in a soundproof room and had distant subjects tell whether playing cards drawn at random from a deck were red or black. Other explorers in this twilight zone of psychology have employed many other methods. Some have used the radio, having listeners write down what they thought the scientists were concentrating upon at the broadcasting studio. Others have tasted different flavors, or

To eliminate the human element from the trials, the cards are shuffled by this novel machine



have pinched themselves in various parts of the body, or have concentrated upon drawings sealed in opaque envelopes, all tabulating the hits and misses of the subjects.

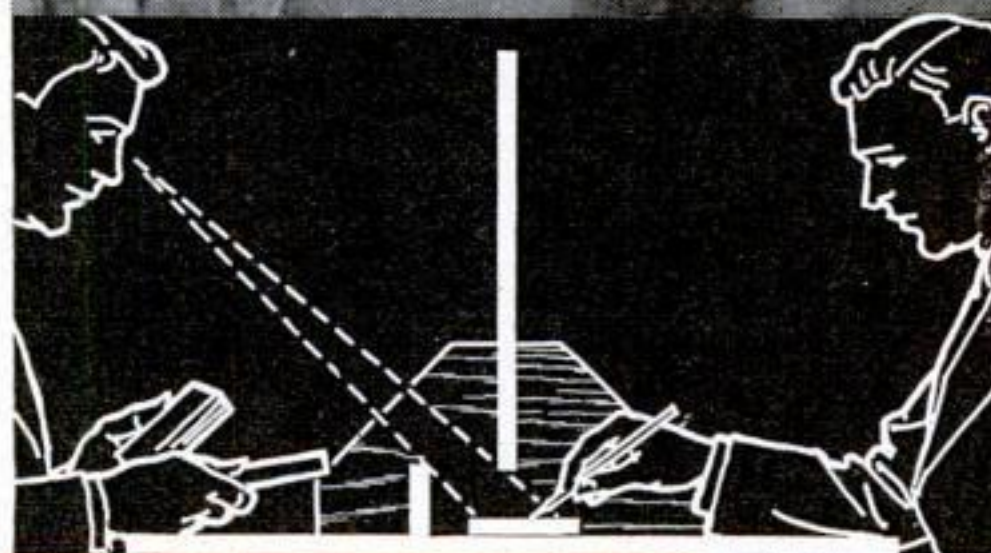
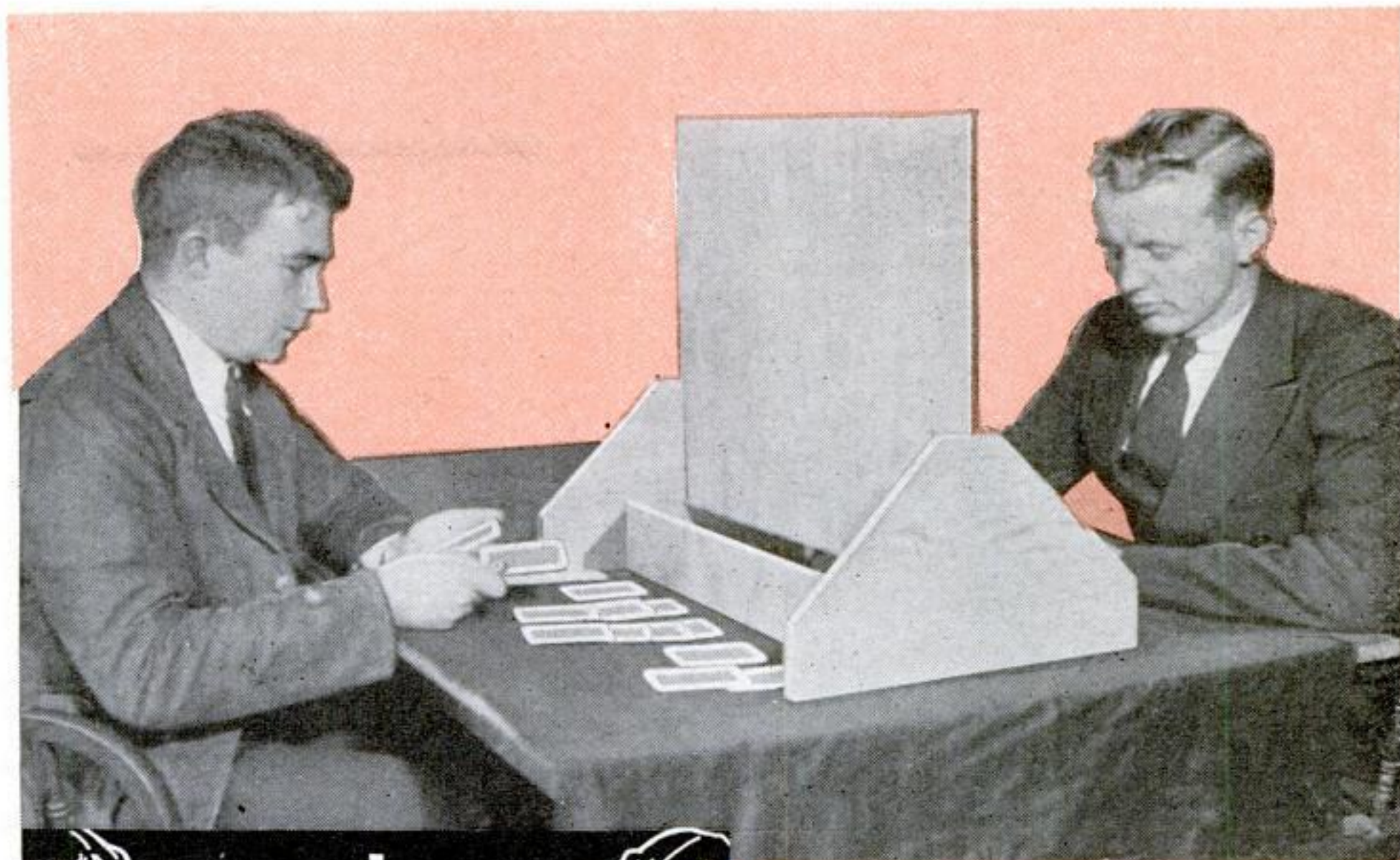
The most definite evidence for telepathy has been reported from Duke University. Here, Dr. Rhine and his assistants have repeated tests with a pack of special cards 100,000 times. The results obtained in those tests form the big news in telepathy research.

They have indicated that every one has some telepathic ability and that a few people are specially gifted. They have shown that telepathic ability seems to run in families. And they have revealed curious facts about the effects of worry and fatigue and drugs upon the scores made in the tests.

When, for example, subjects took caffeine, a stimulant, their scores rose; when they took sodium amytal, a depressant, the scores fell. In some little-understood way, the nervous system of the body was playing its part in the results. Again, the distance which separated the subjects seemed to have little effect upon the scores. The marks were just as high if they were 100 miles apart as when they were separated by only a few feet.

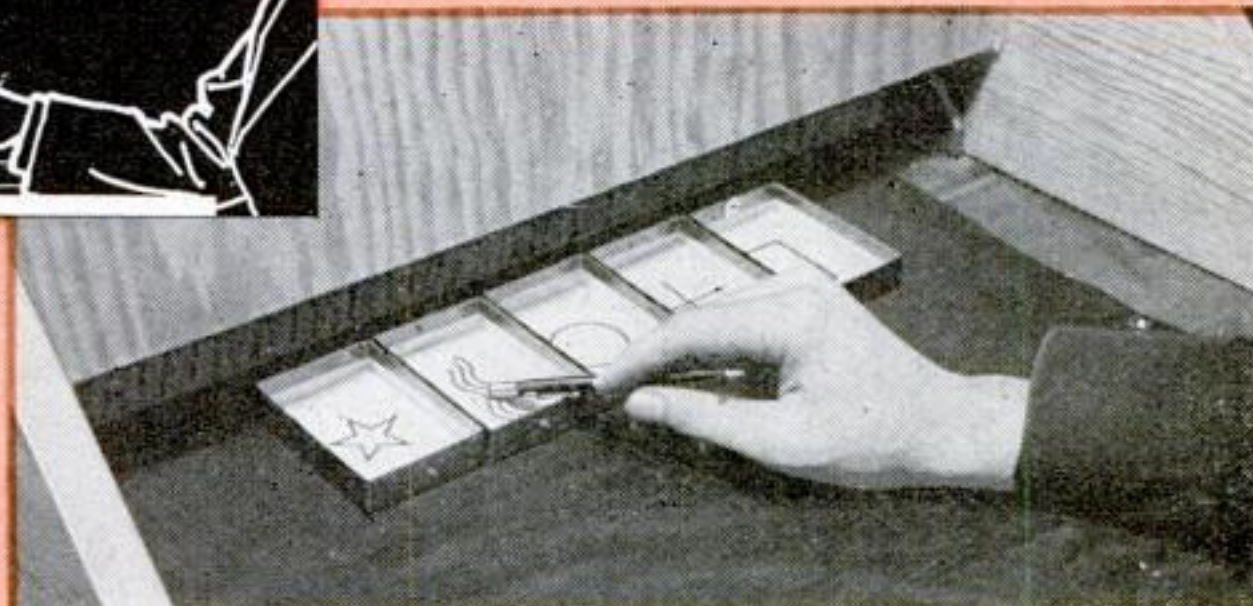
When I visited Dr. Rhine's laboratory, not long ago, one of the most dramatic tests so far attempted was under way. In a quiet room on an upper floor of one of the university buildings, a man sat at a desk holding a specially adjusted watch in one hand. As the second hand swung past the sixty mark, he lifted a card from a small pack lying before him. On its face was a large star. For sixty seconds, he gazed intently at the card. Then he laid it down and took up another card, and so on through the pack.

Three thousand miles away, on the Pacific coast, another man was sitting with a pencil in one hand, a synchronized watch in the other. At the exact time the North Carolina scientist was looking at the star, the California subject was noting down which of five designs—a star, a cross,



In this test, the subject sits behind a screen which leaves his hands visible to the experimenter, while making it impossible for him to see the cards drawn

As each card is chosen, he points a pencil to a chart of the symbol he thinks it bears. The card is then placed in the corresponding pile for a later check for accuracy



wavy lines, a rectangle, and a circle—that appear on the cards of the pack, he thought had been selected.

Paradoxically enough, early returns from these tests show higher scores than many previously made with the subjects separated by only a screen!

In all his tests, Dr. Rhine has used twenty-five cards in a pack, five of each design. Thus, on every "call," or try, the

subject has one chance in five of being right, just by luck. If, the scientist reasoned, enough tests are made, the average number of correct calls must flatten itself to the chance level of five in twenty-five if luck alone controls the result. If, however, in a large number of trials, the scores rise above this level, it will prove some other factor, the mysterious something we call telepathy, is playing a part. So much for his plan. Now let's examine the results.

One of the first men to take the test was A. J. Lintzmayer, a Duke University psychology student. In his first 600 calls, he got 238 right—almost exactly twice as many as chance allowed him. Even more spectacular was the performance of Hubert Pearce, a divinity student at the university. He took 11,250 tests and averaged nine correct in every twenty-five from beginning to end. Once, Pearce correctly called thirty-five cards in succession.

More significant than records of the star performers are the figures for the whole 100,000 tests. Including the marks of dozens of subjects, the average runs at more than seven right in twenty-five.

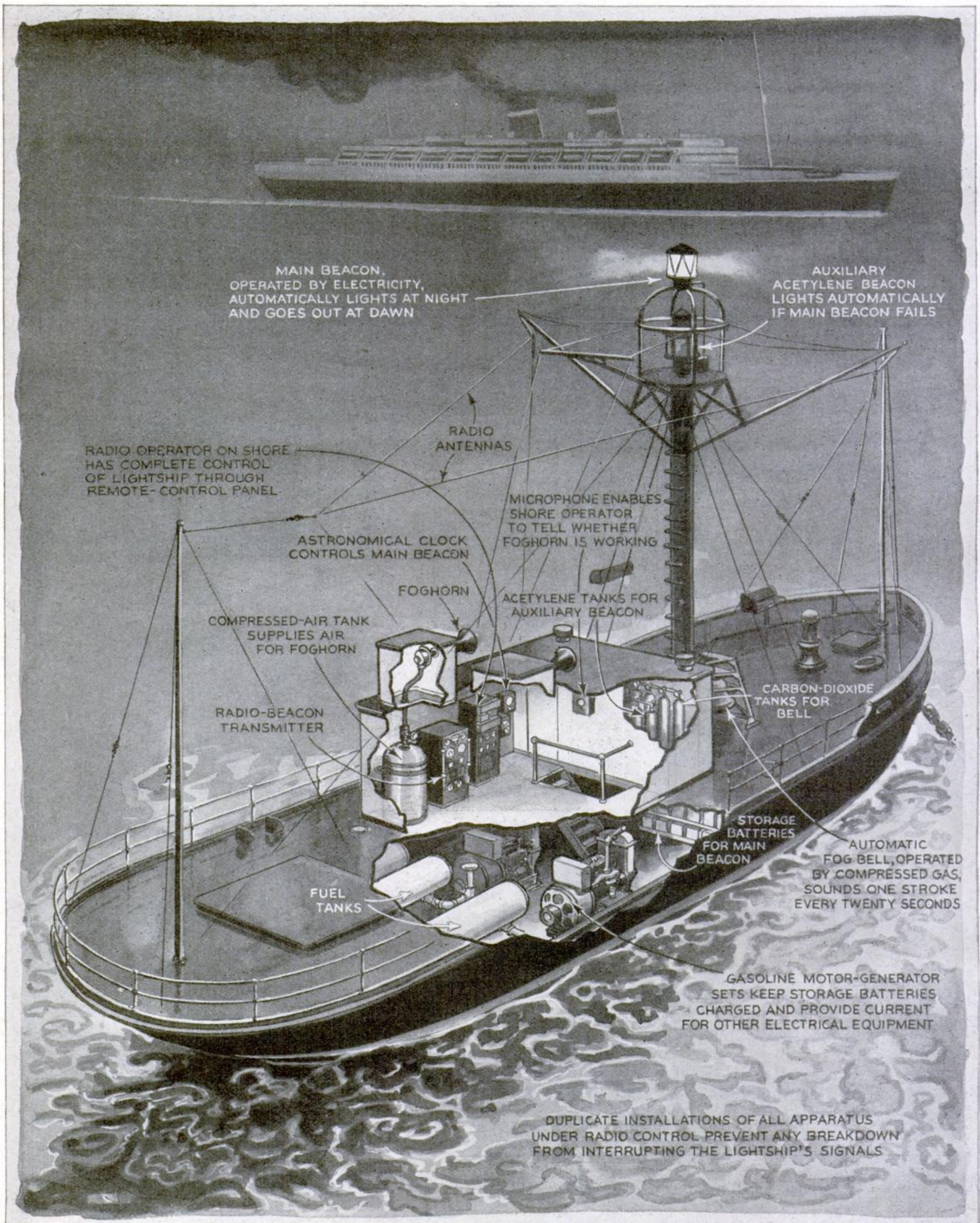
To approach the problem from as many angles as possible, Dr. Rhine has varied the tests widely, always using the same kind of cards. In some cases, the subject writes down his calls, in others he puts his finger or pencil on the indicated design, in others he presses down a telegraph key which lights up a window holding the design he has picked. Sometimes, calls are made in time with the clicking of a metronome to see if the speed of decision affects the results. By shuffling the cards in an automatic (Continued on page 109)

ARE YOU A MIND READER?

With a set of homemade cards, you can try Dr. Rhine's mental-telepathy test right in your own living room

- 1 From thin cardboard, or heavy wrapping paper, cut twenty-five cards, making them approximately two and one half by three and one half inches. On five of the cards draw a large cross; on five a circle; on five a rectangle; on five a star; and on five three wavy lines. Shuffle the cards thoroughly.
- 2 Have a friend, sitting where you cannot see him, look at the cards one after the other at the rate of about one a minute. As he looks at each card, he should concentrate on the design.
- 3 As he signals each new card by tapping with a pencil, write down the design you think he is looking at. Try to keep your mind blank, and put down the first impression you get.
- 4 At the end of the run of twenty-five cards, compare your list with the cards, which have been kept in their original order. Chance allows you to get five right out of twenty-five. A higher score, according to Dr. Rhine, indicates the functioning of telepathy.

Crewless Lightships



MARKING A TRAFFIC LANE OF THE SEA—WITH NOT A SOUL ABOARD!

Manned only by automatic and radio-controlled devices, and moored in the most exposed and dangerous locations on the Atlantic and Pacific coasts, lightships like this will safeguard shipping in night, fog, and storm without risk of life

Controlled by Radio

PLANS for a chain of robot lightships, strung out all along the Atlantic and Pacific coasts, are reported under development by the U. S. Lighthouse Service. Operated by radio control from the shore, the vessels would carry no crews. Hence they could be moored in the most dangerous and exposed locations. Buffeting by wind and waves would not trouble their actual operators, comfortably housed in land stations miles away. Loss of life would be averted if a liner should collide with one of the vessels in a fog.

For evidence that the scheme is practical, Lighthouse Service engineers point to the successful prototype of the projected vessels—the robot lightship *St. Clair*. Stationed in Lake St. Clair between Lake Erie and Lake Huron, this crewless 160-ton craft has vindicated the hopes of its designers in its first year of service. Semiautomatic apparatus controlled by radio from a land station eight miles away, and fully automatic equipment requiring no human control whatever, have enabled it to perform all the duties of a fully manned lightship. Its ingenious design, expected to serve as a model for future vessels of the type, gives an advance view of how they will be operated.

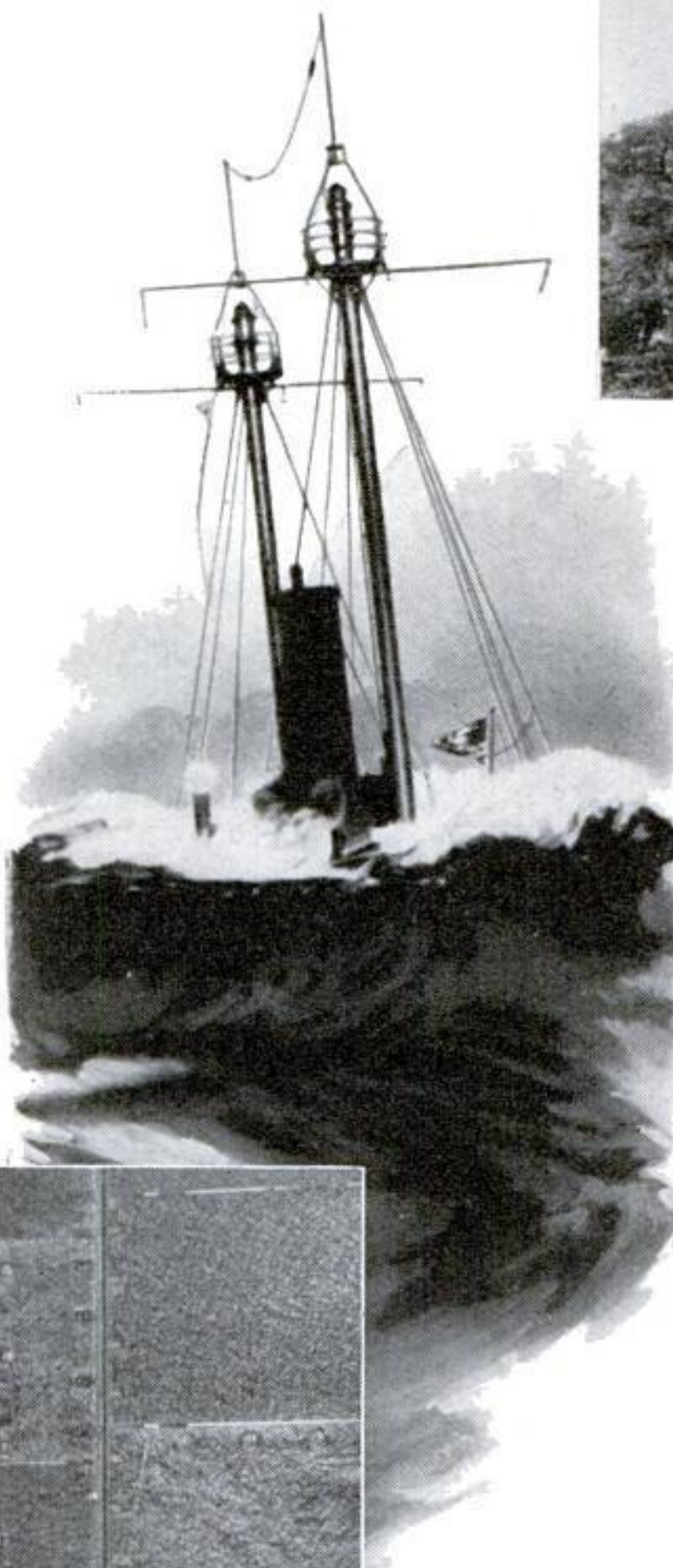
In fair weather, the *St. Clair* runs itself. Once every twenty seconds, a stroke is heard from its bell, which is actuated by compressed carbon dioxide gas from cylinders containing enough to last for months. Fifteen minutes out of every hour, a self-operating radio beacon gives near-by ships their bearings. At night, a powerful electric beacon at the masthead automatically lights, and at dawn it shuts itself off; the shifting cams of the “astronomical clock” that controls it keep pace with the changing seasons to follow sun time instead of standard time. If the

electric light should fail, an auxiliary acetylene beacon automatically lights up to take its place. Generators start and stop, at appointed times regulated by control clocks, to recharge the storage batteries that furnish electric power.

Suppose, however, that fog is gathering. Now the shore operator takes over control. He presses a button. A musical tone signal flashes through the ether to a receiving set, attuned to this particular note, aboard the *St. Clair*. Like well-trained sailors responding to a bugle call, the electrical crew goes into action. Relays

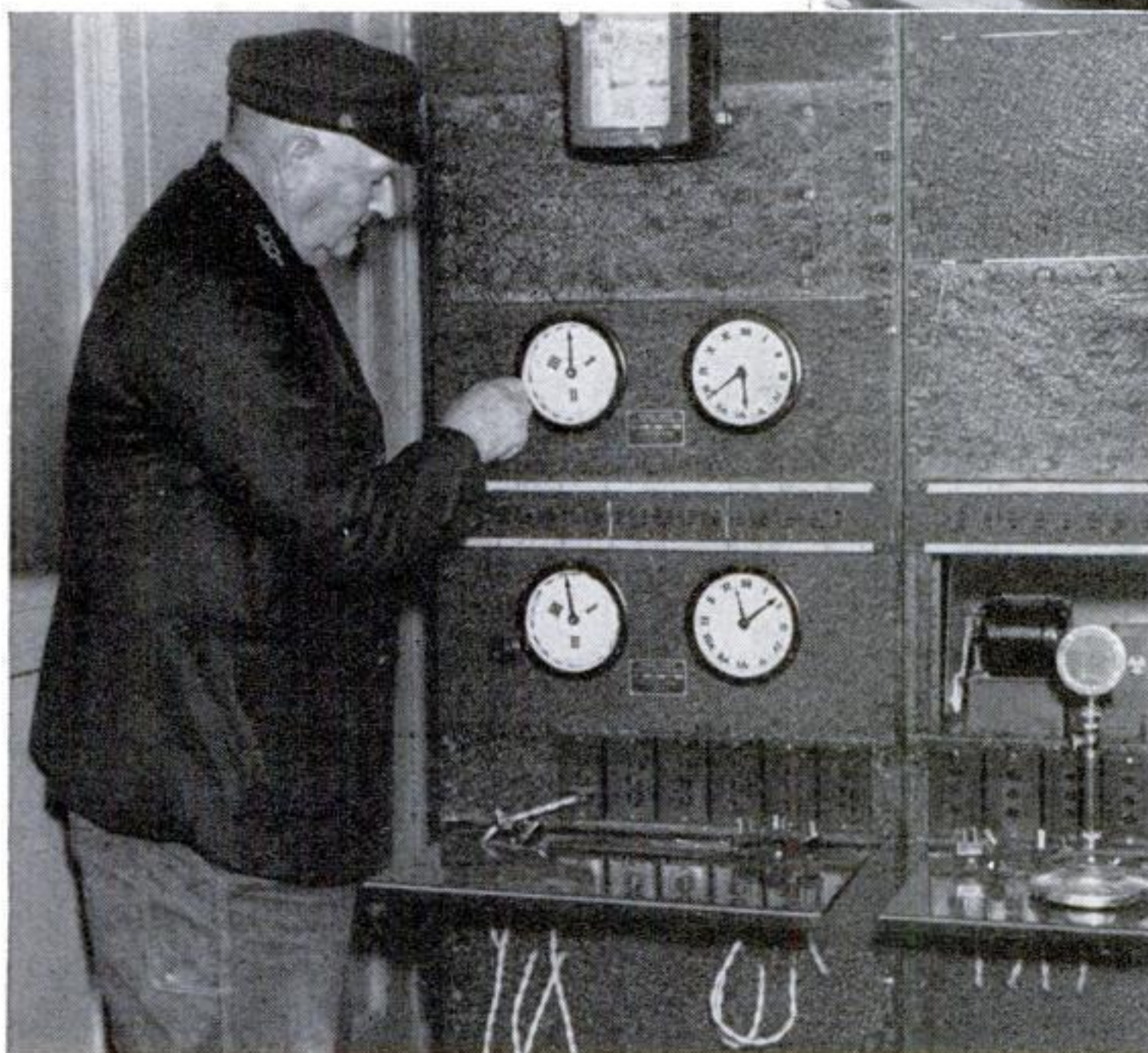


If present tests prove successful, all light-houses soon may be operated by radio control



A lightship in heavy weather. With radio control, men are spared exposure to such dangers

Left, dual clock sets on beacon-timing equipment that synchronizes foghorn and radio signals to enable ships to estimate their distance from a lightship or shore beacon



click upon a remote-control panel. A foghorn starts bellowing. An idle generator begins to hum. The radio beacon changes over from intermittent to full-time operation. All the aids that science can offer to ships groping their way blindly through the murk are set working.

What if any of the equipment of the crewless vessel should fail? The shore operator's own radio receiver warns him of any trouble with its radio beacon. Sometimes, however, the foghorn cannot be heard ashore. So a microphone aboard the *St. Clair* takes over the role of watchman. If one of the horns should go out of service, the microphone actuates an electric circuit that interrupts the continuous radio-beacon signal for five seconds each minute, as a trouble signal to the control station.

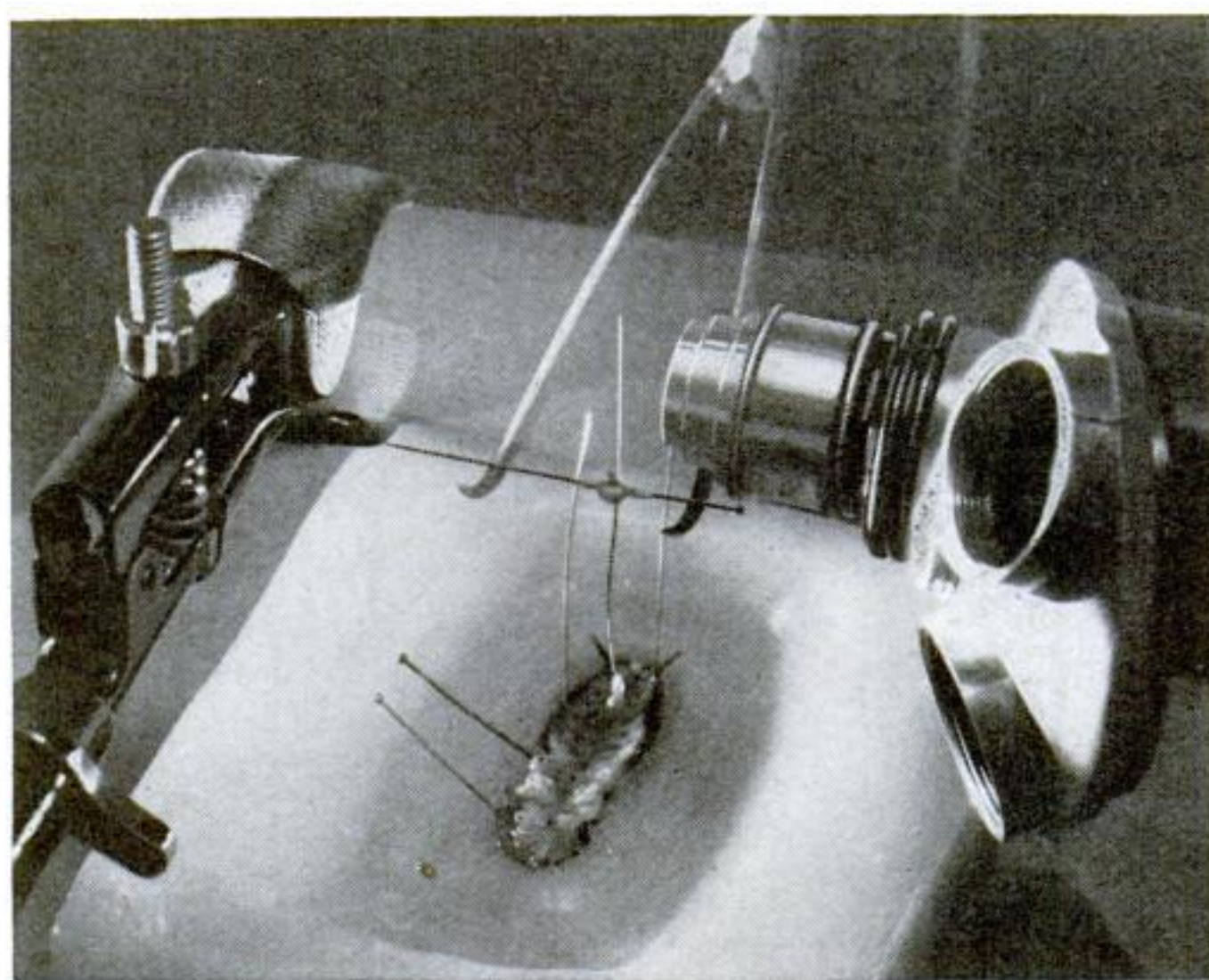
All radio-controlled mechanism on the *St. Clair* is in pairs—fog horns, generators, and radio-beacon equipment. The moment that anything goes wrong in one of the duplicate installations, the shore operator has only to push a second button to put the substitute set of apparatus in operation. Repairs can be made later by tender crews.

In other ways, too, radio has come to the fore as an adjunct of new aids to navigation. Foghorn and radio signals, combined, now give a vessel its distance from a lighthouse or lightship. Emitted simultaneously, they reach a distant craft at different instants. The radio signal travels practically instantaneously, while the sound signal takes five and a half seconds to cover each nautical mile. By timing the interval between their arrival with a stop watch, the master of a vessel can compute his distance from the station to an accuracy within the length of his own ship.

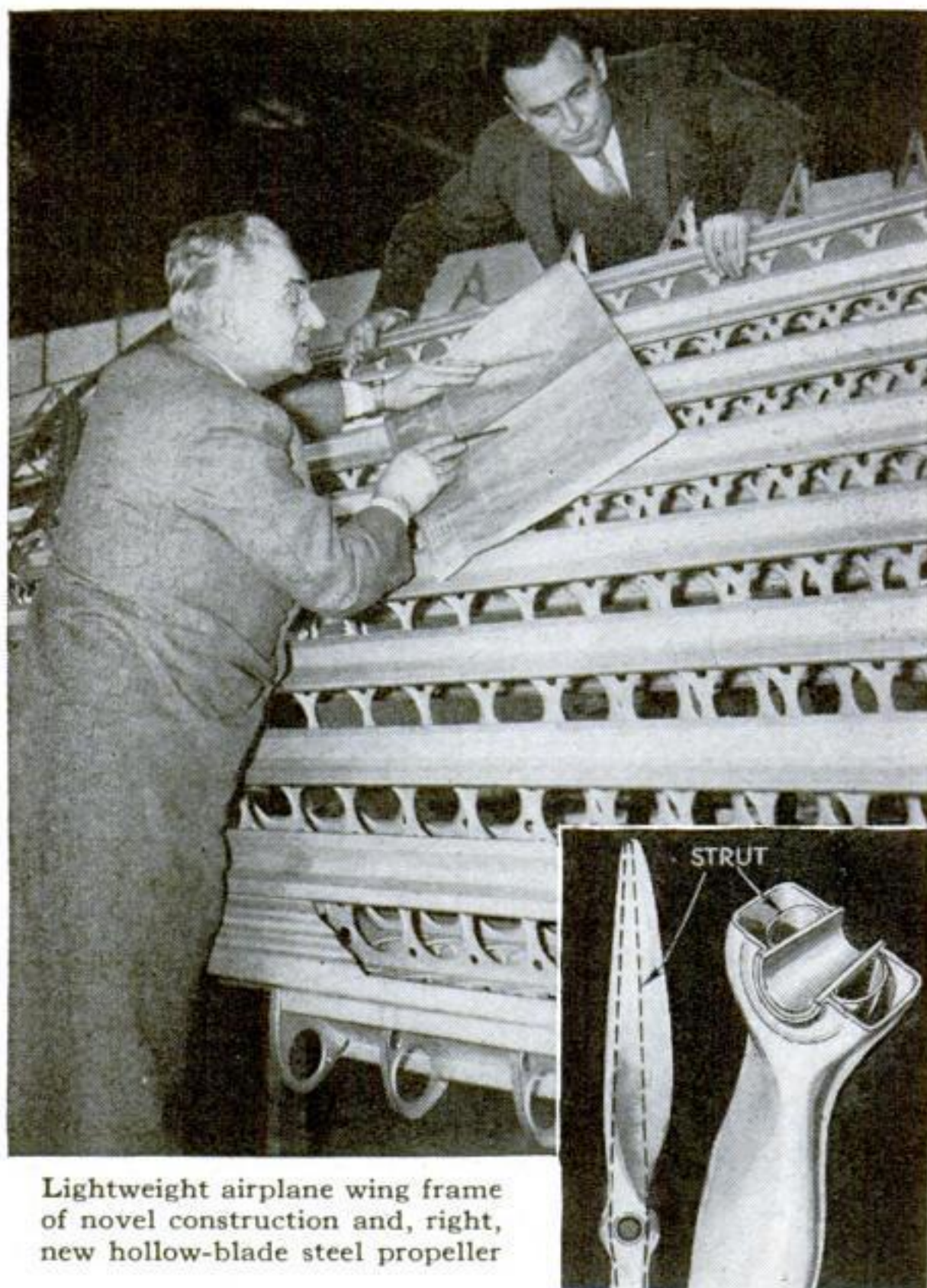
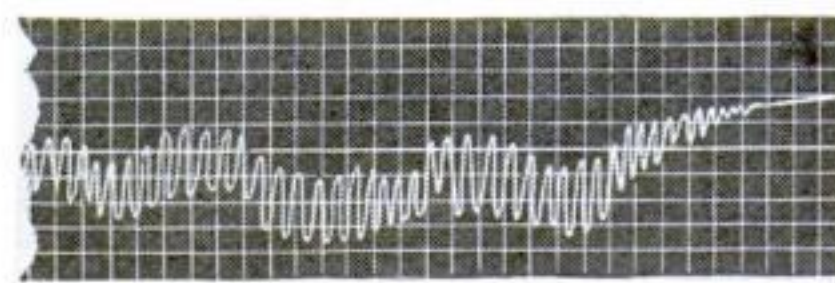
Instrument Records Cockroach Heartbeats

SUCH minute movements as the pulsations of a cockroach's heart have been recorded photographically by a "mechanocardiograph," a superdelicate instrument designed by Dr. J. Franklin Yeager, research entomologist in the U. S. Department of Agriculture. With the aid of the apparatus, Dr. Yeager has been studying the effect of nicotine, a common insect poison, upon cockroaches. In his researches the roach is anesthetized and pinned securely to a hollowed-out block of paraffin. Then the heart is exposed by a delicate bit of surgery and the tiny organ is attached by a human hair to a fine glass needle having a darkened tip. Light, shooting across the blackened needle point, casts a moving shadow into the lens of a microscope as the insect heart throbs back and forth. Magnified many times, the shadow traces the heart movements on a slowly moving sheet of sensitized paper, as nicotine, or any other poison under test, is

administered. Thus a picture of the pulsations of the heart, in the form of a wavy line, is preserved to show the organ's action both before and after the administration of doses of poison. In the course of his studies, Dr. Yeager intends to experiment with many old and new insecticides, not only to get at the basic facts of insect heart action, but also to establish the most effective drugs and poisons for controlling all types of insect pests.



A glass needle, attached by a hair to the insect's heart, traces a shadow picture of pulsations to show the effect of various poisons

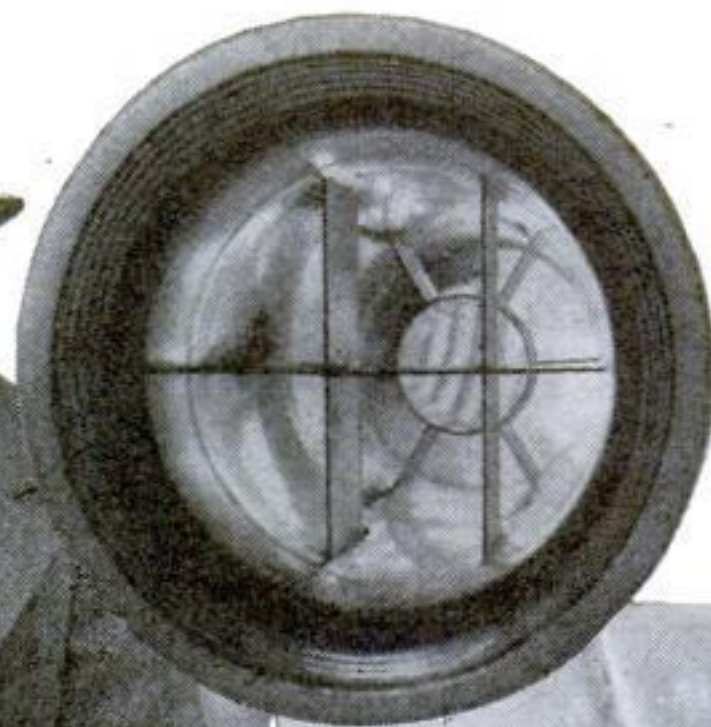


Lightweight airplane wing frame of novel construction and, right, new hollow-blade steel propeller

PLANES GET NEW LIGHTWEIGHT WINGS AND PROPELLERS

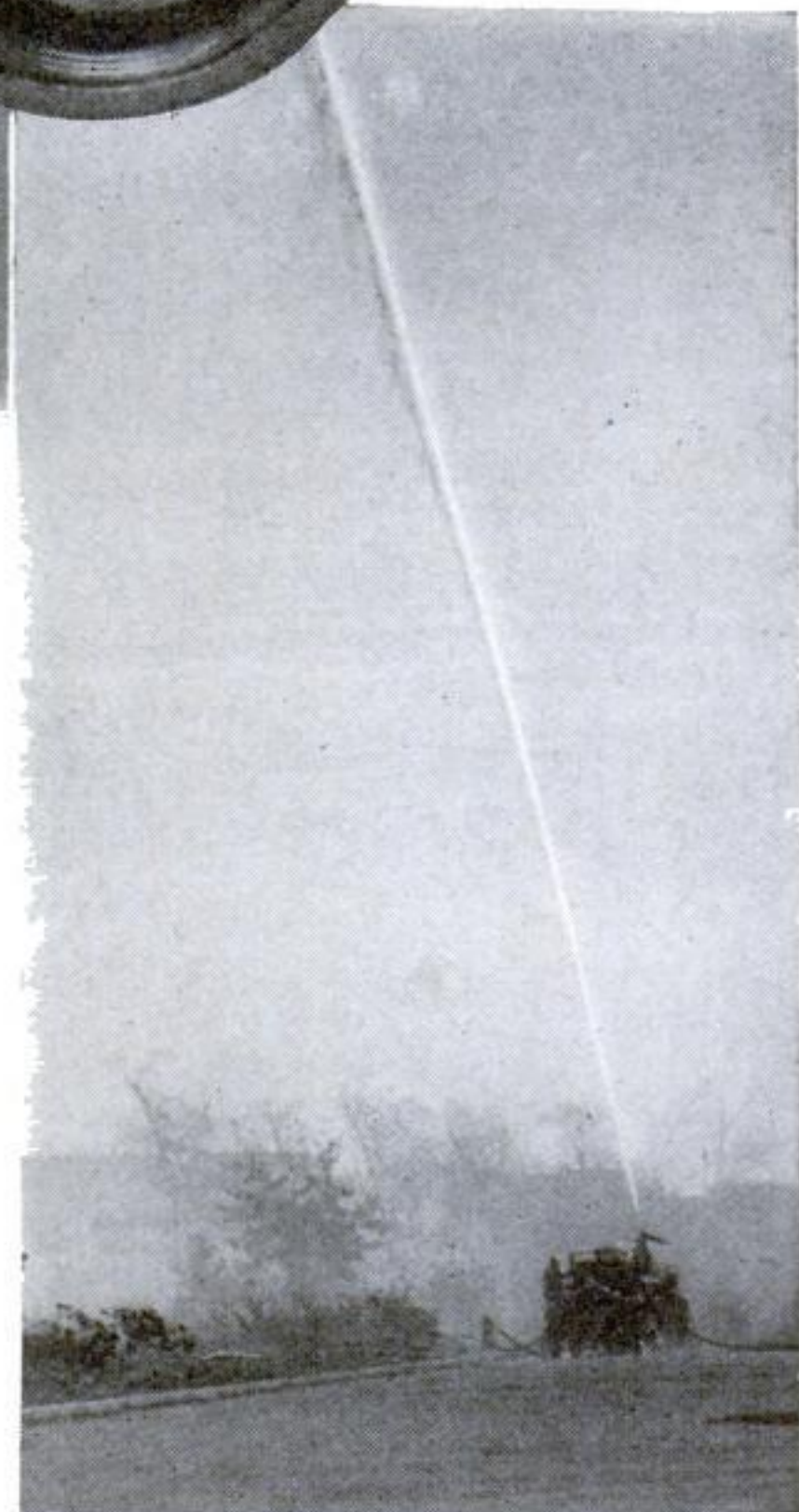
LIGHTER and stronger wings for airplanes are claimed to be made possible by a new frame construction devised by a Detroit, Mich., inventor. Tested recently by U. S. Navy officers, the wing is expected to be practically invulnerable to gunfire. A new plane utilizing wings of this type also will use hollow steel propellers which are braced by a steel strut running the full length of the blades from tip to tip.

FINS IN NOZZLE INCREASE FIRE-HOSE RANGE



End of new hose nozzle, showing the sets of fins that straighten the stream of water. The inventor is seen with one of the nozzles. Below, a test of the long-range effectiveness it affords

METAL "feathers" built into a new type of fire-hose nozzle increase the effective range of streams of water. Invented by Horace Barker of Springfield, Mass., the nozzle has two sets of transverse fins; one set counteracts the swirl of the water as it emerges from the hose, while the other straightens the stream, reducing its spiral motion and its tendency to break into spray as it travels through the air. Experts state that the new nozzle will not only add "punch" and distance to fire-hose streams, but will increase their fire-extinguishing effectiveness as well.





IMPROVES ON NATURE TO KEEP EGGS FRESH

INSTEAD of coating eggs with a foreign substance to keep them fresh, a new chemical preserving process, invented by a Chinese scientist in California, seals the porous shells of natural calcium carbonate with more of the same material. The artificially thickened eggshells retard deterioration by excluding air and moisture, and are strengthened against breakage in handling.

INAUDIBLE SOUNDS SPEED SEED GROWTH

SEEDS subjected to sound waves that are inaudible to the human ear grow faster than untreated seeds, according to experiments being made by Prof. S. N. Rzhevkin, Russian scientist. A pea seed exposed for three minutes to extremely high-frequency vibrations far outstripped a similar seed planted under normal conditions at the same time.



The plant at the left, below, grew from a seed treated with high-frequency sound

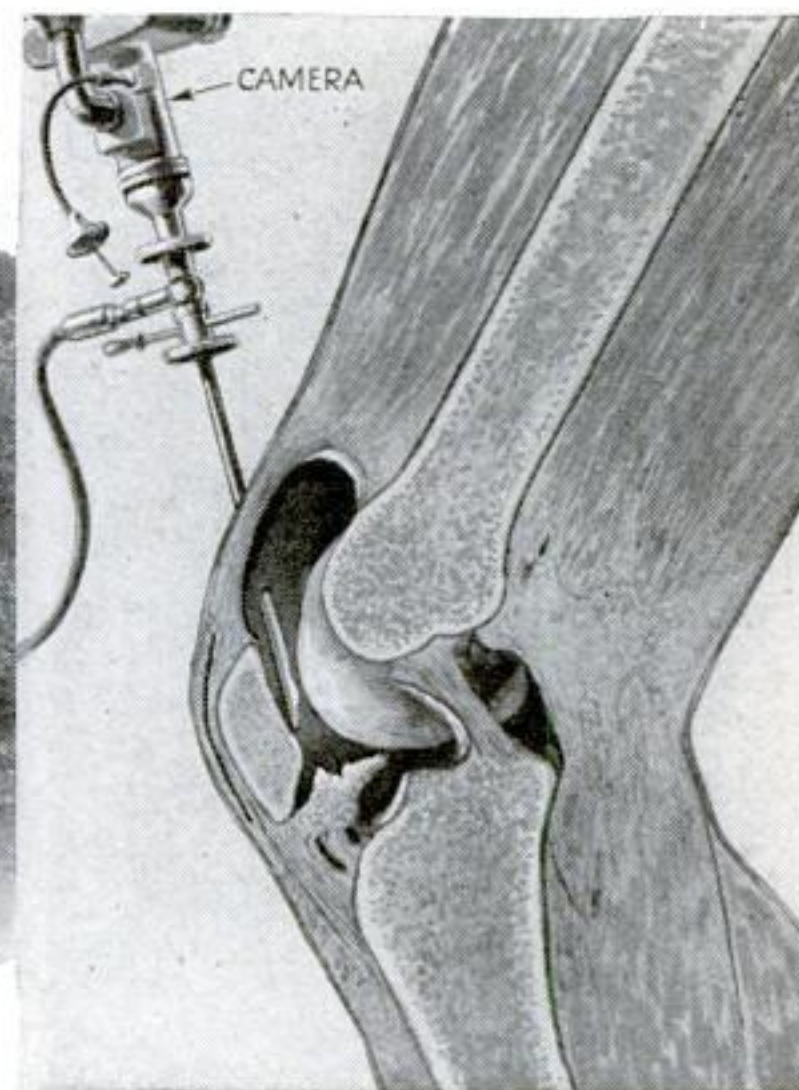
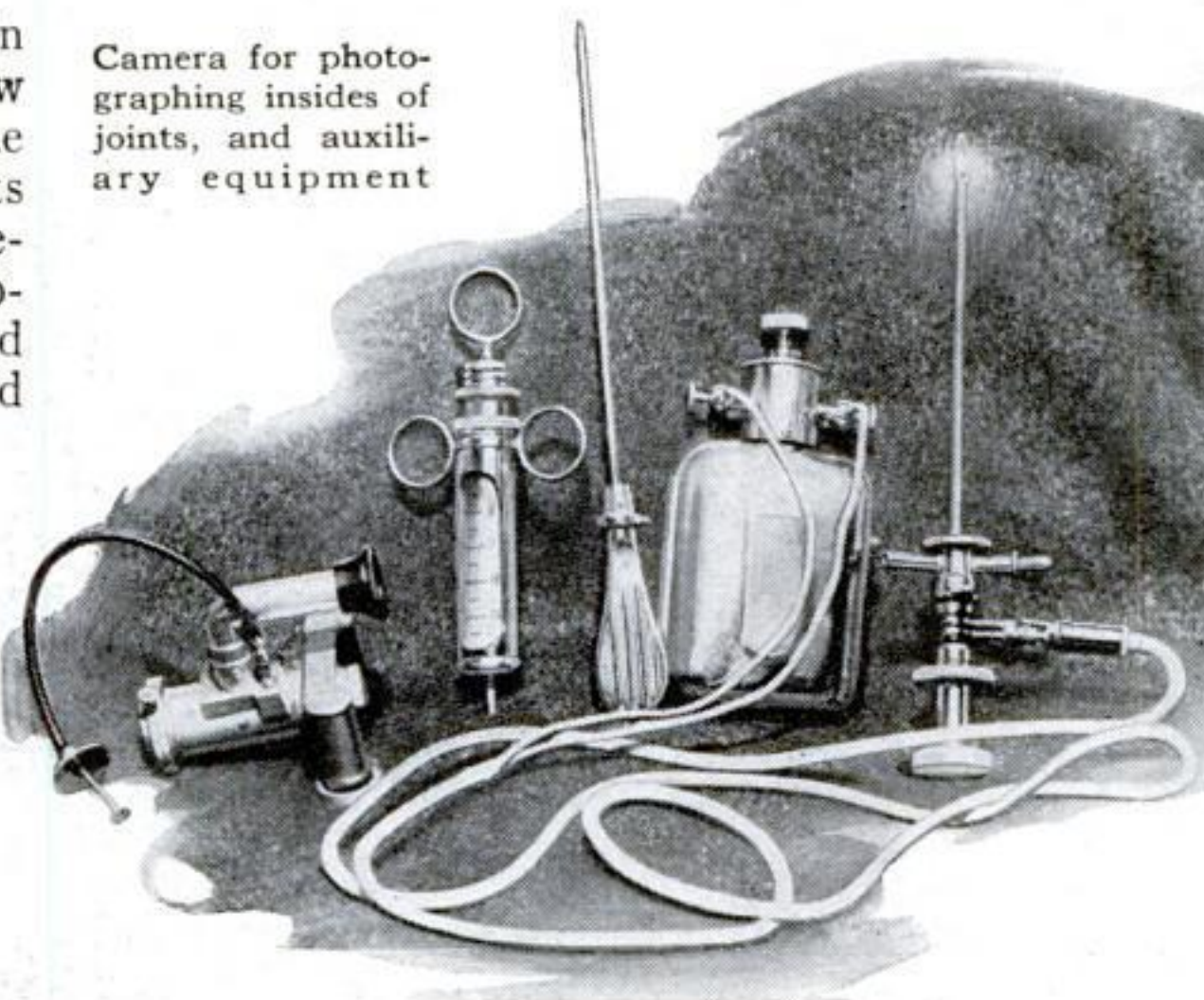


Prof. S. N. Rzhevkin studying effect of sound on seeds

TINY CAMERA PHOTOGRAPHS BODY'S JOINTS

THROUGH a needle-punctured hole in the skin, the tubelike nose of a new camera can be introduced directly into the human body to photograph diseased joints and aid in planning medical treatment. Details that fail to show up in X-ray photographs are said to be as plainly revealed in the resulting pictures as if the affected part were laid bare by a surgical operation. A midget lamp, fed with current from its battery through fine wires, provides illumination for the novel picture-taking method. Invented by a Japanese professor of medicine and known as an "arthroscope," the apparatus includes a small revolving brush and other accessories that may be inserted to clean and bathe the joint. The accompanying illustrations show the complete equipment and its manner of use.

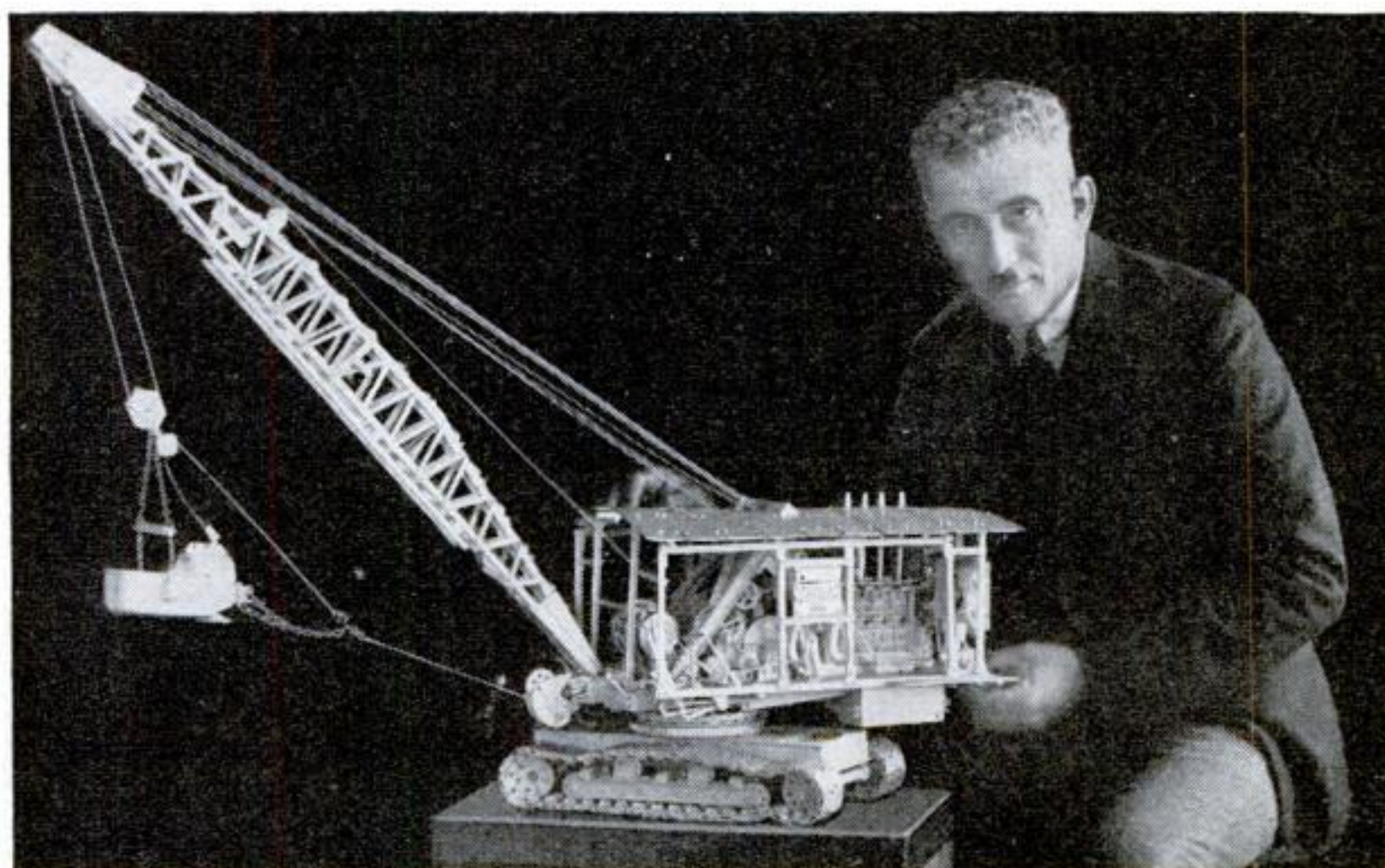
Camera for photographing insides of joints, and auxiliary equipment



How the camera aperture and lamp are introduced into a joint to make a picture

READER BUILDS SCALE MODEL OF EXCAVATOR

ALL the details of an excavating machine that he operates in far-away Egypt are faithfully reproduced in a wooden scale model that a Greek reader of POPULAR SCIENCE MONTHLY, E. Halkidakis, has constructed. The unusual souvenir of his occupation took him three years to complete, at the rate of four to five hours of work each week.



E. Halkidakis with his wooden scale model of the excavator he operates in Egypt

BELL WARNS EARTHQUAKE OBSERVERS

TO NOTIFY the observer on duty that an earthquake is being recorded by the seismograph, the Hawaii Volcano Observatory is equipped with a call bell that rings whenever a tremor occurs. A suspended weight swings when the earth shakes, making an electrical contact that rings the bell and actuates an annunciator to show how strong the shock was.

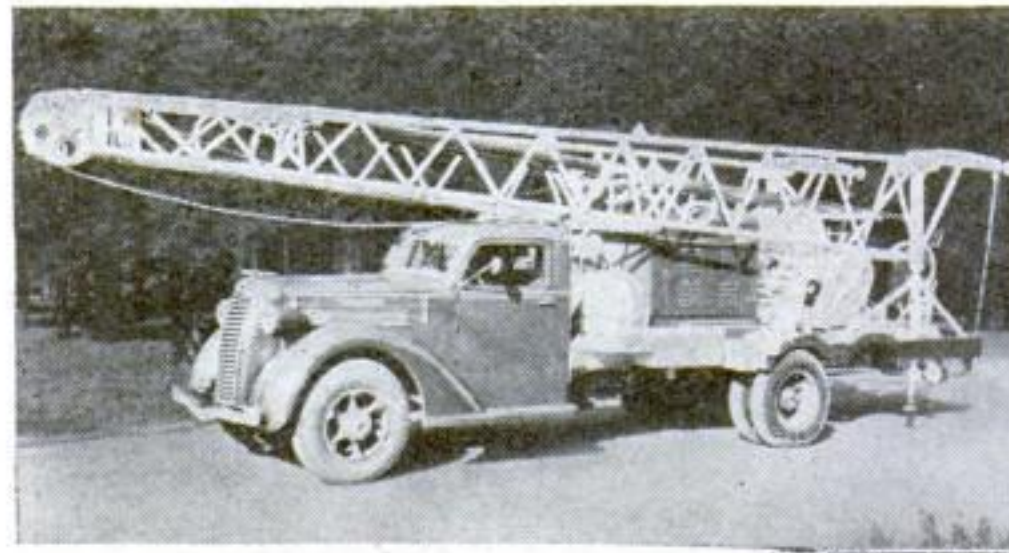
TRUCK CARRIES OIL-DRILLING RIG



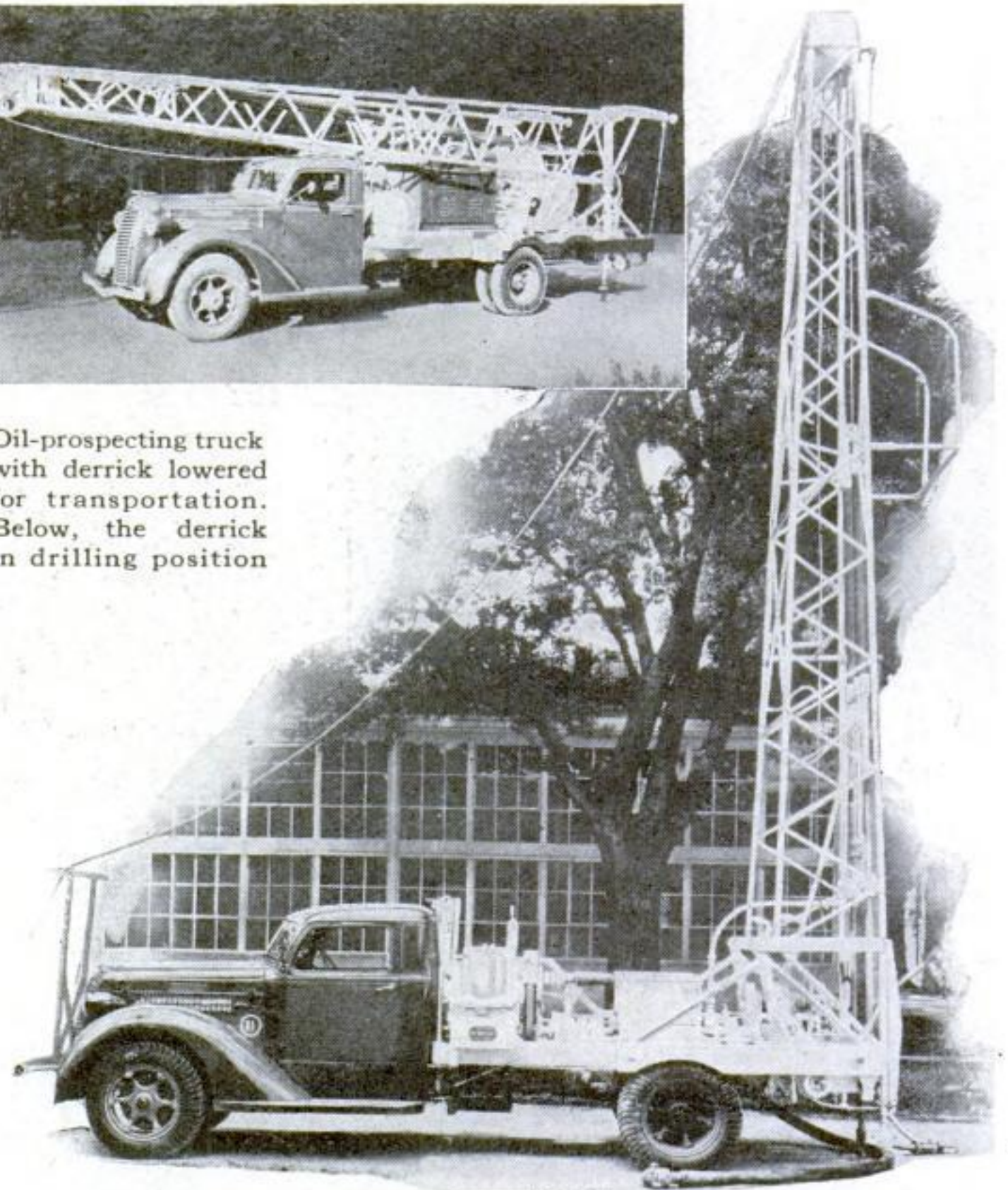
DEVICE PREHEATS ETHER TO PREVENT NAUSEA

DEvised by Dr. Garent King of Los Angeles, Calif., a new device heats ether before it is administered to a patient in the operating room. Ether is poured into a container surrounded by a jacket filled with hot water. Preheating the anesthetic before the fumes are inhaled is said to prevent patients from developing nausea or ether pneumonia following an operation. In the photograph, Dr. King is shown demonstrating his apparatus.

MOUNTED on a standard truck chassis, a portable drilling rig just developed provides an economical and efficient means of prospecting for oil. The truck is fitted with winches and other auxiliary equipment to enable it to cover rough, hilly terrain far from roads and highways. At a chosen site, the truck engine provides power to hoist the derrick, turn the drill, and operate the mud pump which washes away the cuttings as the drilling progresses. The portable rig is capable of drilling a hole 1,000 feet deep, but it is primarily designed for exploratory drilling to about 100 feet.

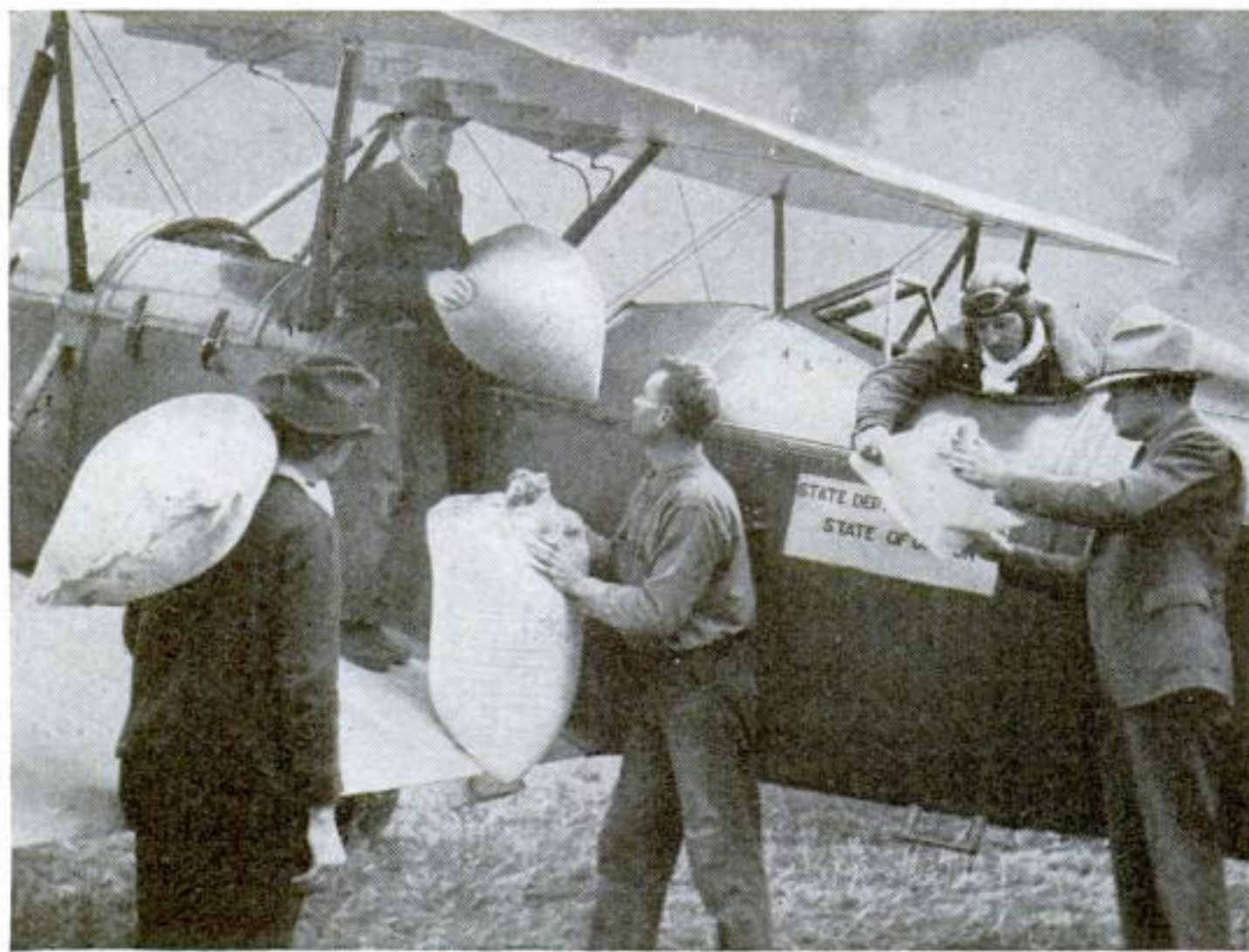


Oil-prospecting truck with derrick lowered for transportation. Below, the derrick in drilling position



PLANE DROPS SEED TO REPLANT FOREST

THOUSANDS of acres of choice timberland, denuded of trees and foliage by forest fires near North Bend, Ore., were reseeded recently from an airplane which flew back and forth over the burned area. The seeding plane was fitted with special fuselage hoppers to carry seed. Trapdoors at the bottoms of the hoppers, controlled from the cockpit, enabled the pilot to release quantities of seed over designated areas.

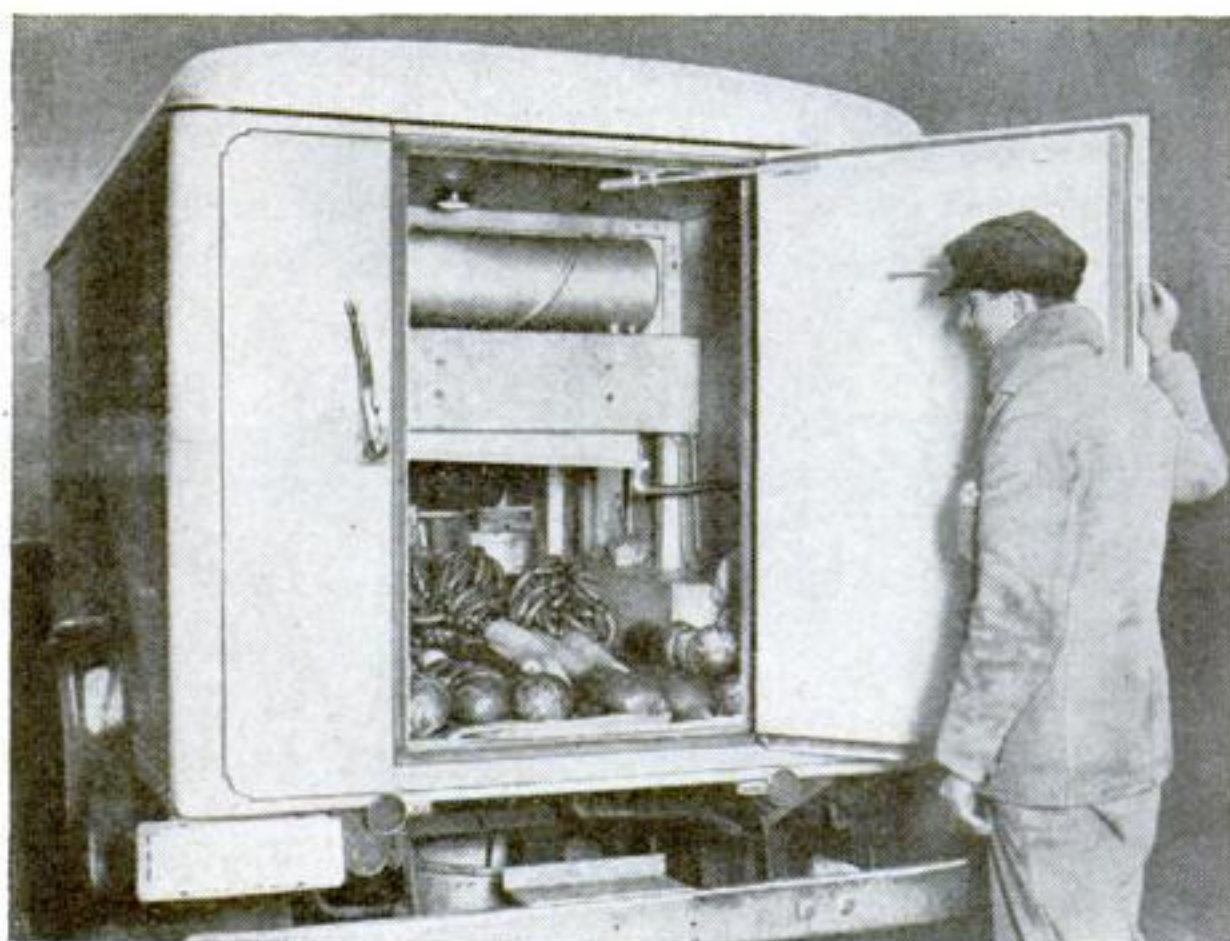


Seed being dumped into fuselage of plane from which it will be scattered



GENERATES DRY GAS FOR AVIATION FUEL

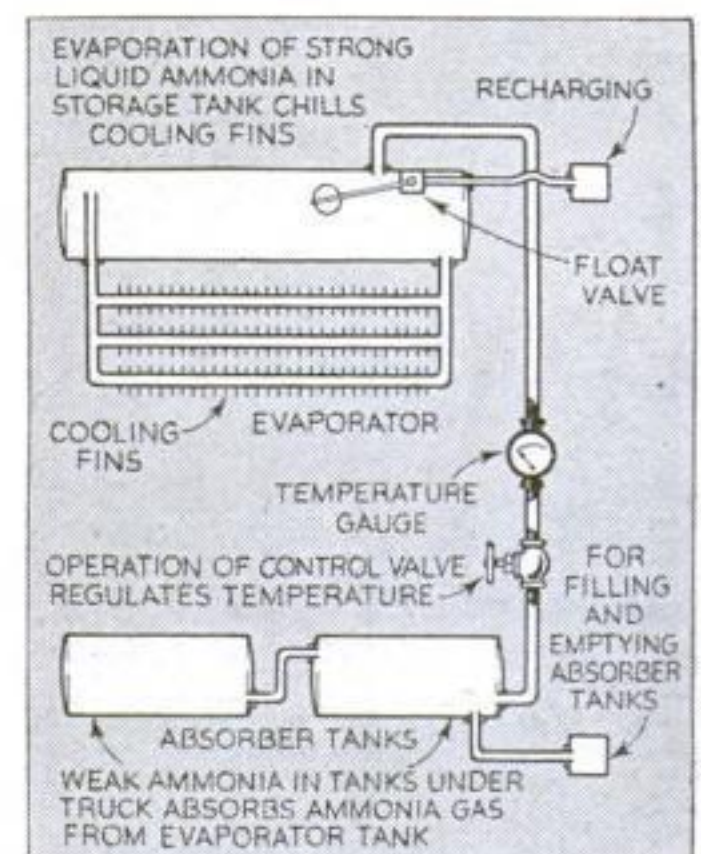
TO INCREASE the efficiency of airplane engines, a new motor attachment generates a dry gaseous fuel from gasoline to replace the moist vapor created by conventional carburetors. Liquid fuel is transformed into a pure gas, mixed with oxygen, and fed into the engine cylinders. Tested in a recent flight, the dry-gas generator is said to insure complete and efficient combustion of fuel.



Truck equipped with automatic, motorless refrigerating unit

NOVEL REFRIGERATOR COOLS DELIVERY CAR

ECONOMICAL cooling of perishable goods transported to market in trucks or freight cars is provided by a new motorless refrigeration unit just developed. The easily installed equipment consists principally of a steel tank fitted with finned surfaces and charged with strong liquid ammonia. As the ammonia evaporates, the liquid cools the tank and the surrounding air by absorbing the heat within the truck body. The evaporated refrigerant then carries the heat through pipes to outside absorber tanks, where it is dissipated into the air. Temperatures as low as zero Fahrenheit can be maintained by making simple adjustments with a control valve.



How low temperatures are produced without usual compression of gas by evaporation of liquid ammonia



TRY MENTAL EFFECTS OF HIGH FLYING

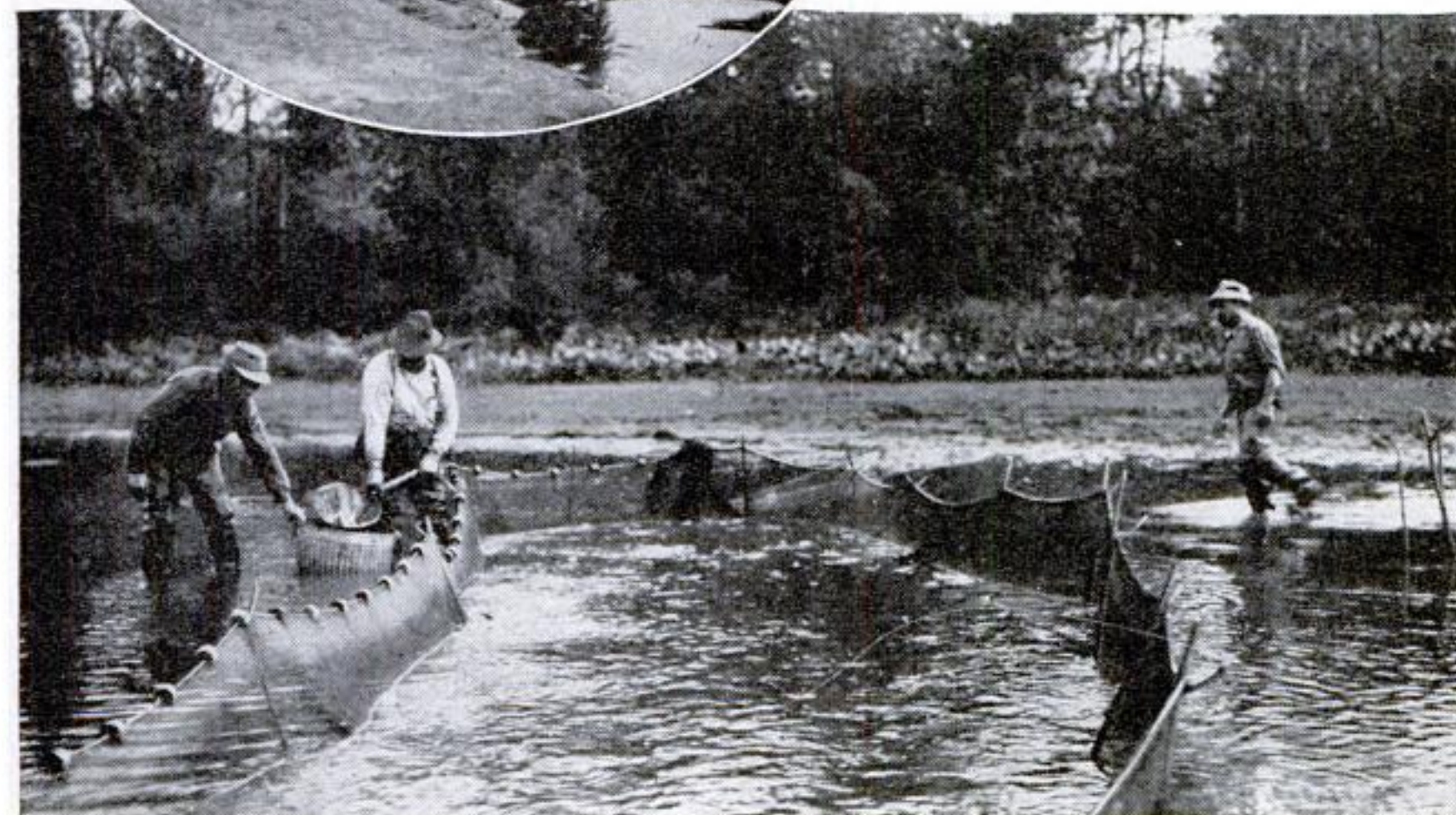
PREPARING for the introduction of high-speed substratosphere plane service, a transcontinental air line recently studied the effects of lack of oxygen at high altitudes. Flying at heights of 20,000 feet and over, subjects were given simple arith-

metical and writing problems both before and after administration of oxygen. Above 16,000 feet, the subjects became progressively slower and less accurate, but when oxygen was given them through tubes their reactions were restored to normal.

FISH ARE RESCUED FROM LANDLOCKED PONDS

FIFTY MILLION game fish have been rescued from certain destruction by agents of the Federal Bureau of Fisheries operating in the headwaters of the Mississippi River in Wisconsin, Minnesota, Iowa, and Illi-

nois. When the river overflowed its banks last spring, fish laid their eggs in the shallow ponds formed by the flood. As the waters receded and dried up, these pools were cut off from the main stream. Working in teams, Bureau agents dragged seines the length of the landlocked ponds, transferred the fish to tubs, and then released them in various tributaries of the Mississippi. Dogfish, gar, and other predatory fish which feed on the eggs of game fish were separated from the main haul and destroyed.



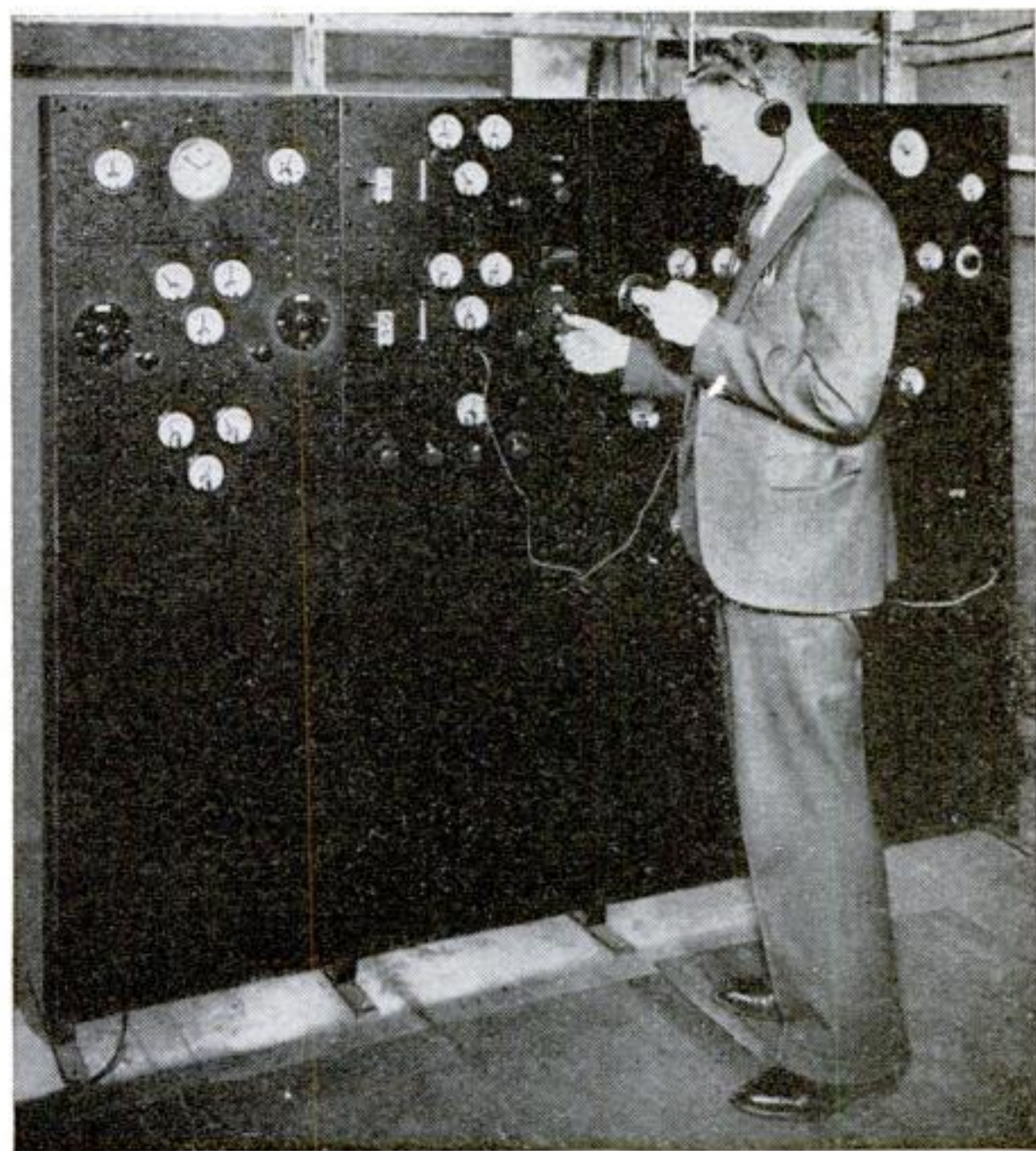
U. S. Bureau of Fisheries agents dipping young fish from a seine in a pond left landlocked by receding floods. In the circle, fish are being released in the Mississippi

SLOT MACHINE DELIVERS ELECTRICAL SHOE SHINE

SHOES are shined by an electrical device just introduced. When a coin is inserted, a polish container unlocks and the customer applies the liquid. A motor-driven brush on a flexible shaft then whirls for a period long enough for a person to shine both shoes.



A rotary brush on a flexible shaft shines shoes



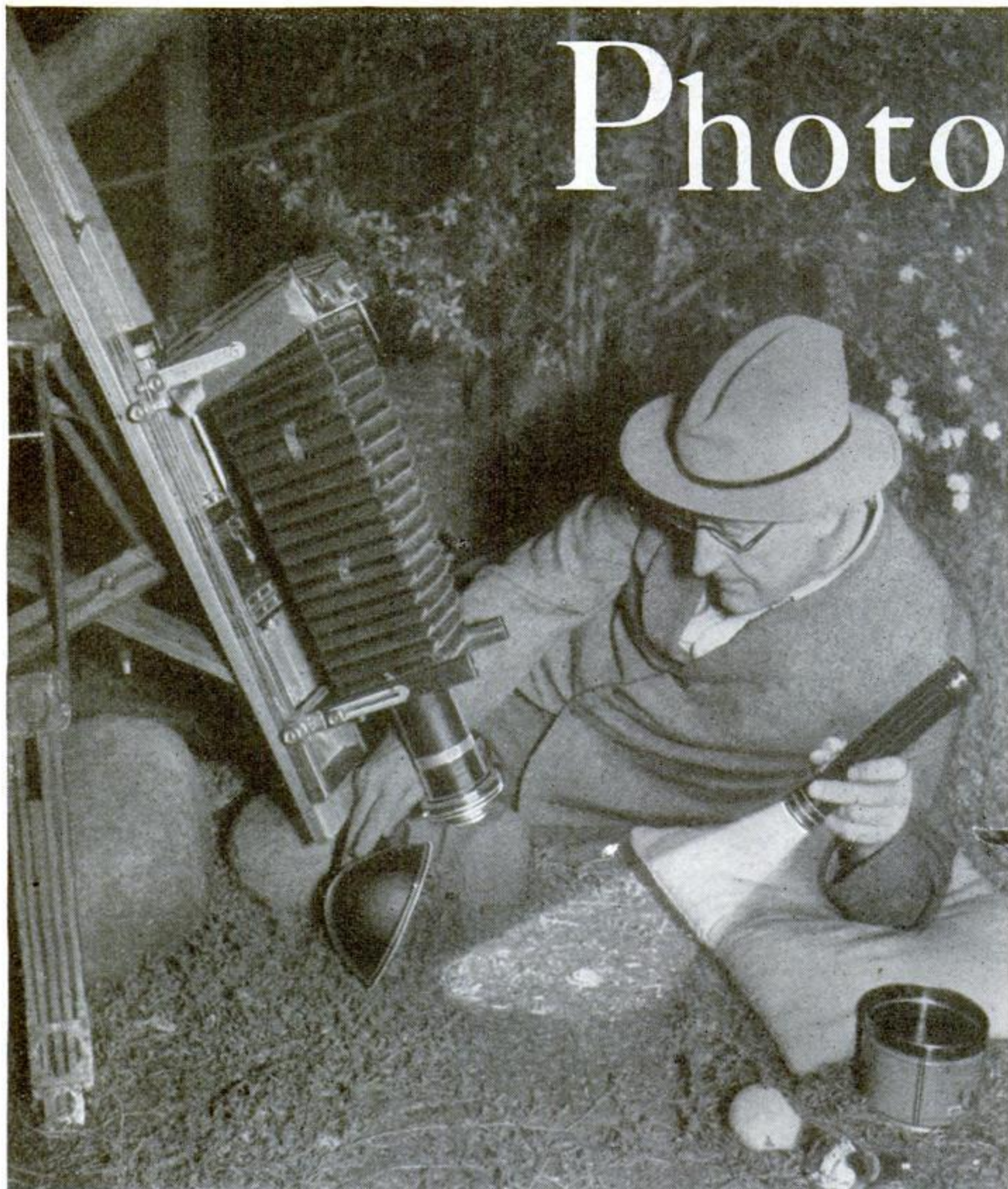
MASTER CLOCK SPLITS SECONDS INTO 100,000 PIECES

ALTHOUGH its panel board resembles that of a high-powered radio transmitter, the apparatus shown in the photograph above is actually an electric clock developed by General Electric engineers to serve as a standard for calibrating instruments and for measuring the exact frequency of broadcasting-station wave lengths. Its "pendulum" is a thin strip of natural quartz crystal which expands and contracts in response to electrical charges. Fractions of time as small as a hundred-thousandth of a second can be accurately measured, and the clock cannot vary from celestial time by more than a minute in eighteen months.

Photographer

*Twenty Thousand Pictures
From Lee Passmore's Camera
Add to Our Knowledge of
The Underworld of Nature*

By
ANDREW R. BOONE



Lee Passmore on guard beside a trapdoor spider's nest, waiting to snap a picture of the odd creature as it comes out to feed. At the right is a close-up of the spider herself and, below, a rare view of her dragging a sow bug through the hinged door of her home



ON A dark, wind-swept mesa near the San Diego River in southern California, a man lies prone upon the ground. In one hand he holds a long flash light, directing its glare at intervals on the door of a trapdoor-spider nest, a flat disk no larger than a half dollar. The other hand rests on the switch of a "flash gun," while a carefully trained camera waits with its shutter open, ready to catch a picture.

Time crawls. The vigil, commencing at dusk, continues through the night. At ten o'clock, the door moves upward slightly and is lowered again. Thirty minutes later, it swings open a quarter inch, and again is closed. Midnight passes. As the clock nears two, the door swings boldly open; a female trapdoor spider emerges to pounce upon a sow bug placed there as "bait," and retreats into her nest. In that brief moment, Lee Passmore touches the light button, a flash lamp illuminates the scene, and the camera records the lightning-fast action.

For fifteen years Passmore, a commercial photographer living on the outskirts of San Diego, has been studying the life stories of spiders and insects. He has taken 20,000 photographs, many in the still of night, while keeping lone watches in the yard of his home and on the mesas near-by. Trapdoor spiders, tarantulas, wasps, black widow spiders, giant water

bugs, solpugids, robber flies, blue-bottle flies, katydids, earwigs, sow bugs, cockroaches, wolf spiders, grass spiders, horned lizards, and scorpions—all have revealed the most intimate details of their lives for his battery of still cameras.

Passmore frequently discloses to science new facts about some little-known insect or spider. It was he who first photographed the egg sac of the trapdoor spider, showed male water bugs carrying scores of eggs on their backs and hatching them, proved that young scorpions come from eggs, got a picture of a male trapdoor spider after a twelve-year search, demonstrated that cockroaches do not need their mother's help to burst out of their eggs, and recorded the intimate details of a tarantula laying eggs and protecting them against parasites within a cradle of webbing.

Near Lemon Grove, Chula Vista, and National City, for 300 nights within thirty months, Passmore kept watch over the doors of trapdoor-spider nests. At dusk, he tiptoed to the scene, set up his camera, laid a pillow or blanket, took his position, and waited. From a small can he released sow bugs within two inches of the door. Occasionally the vibrations from their feet drew a female to the door.



As she pounced, always holding the door open with her abdomen for safe retreat, Passmore snapped the picture.

But this gave him only part of the story. He dug up nests in large chunks of earth, carried them home, and cut away the sides. Working quietly in his own yard, he obtained the first pictures ever made showing the spiders "at home" within their web-lined burrows, and their beautiful eggs confined within delicate but strong sacs.

He has transplanted dozens of these furred creatures to the yard just outside his bedroom window. This he accomplishes by boring into the earth with an auger and slipping the burrow, which in some cases measures eight inches long, into the hole, leaving the top slightly above the earth's level to prevent water and debris washing in during a storm. When I vis-

of Insects

RECORDS LIFE DRAMAS OF STRANGE CREATURES

ited his home recently, I counted eleven transplanted nests, in some of which spiders have been living for a decade.

No one ever had seen one of these creatures build its nest, nor did anyone know how much time was required. Passmore attacked the problem by placing a two-inch length of mud-walled nest on the ground. Within the superimposed nest he dropped a spider. Above the spot, he placed his camera. For two hours the spider did nothing; then she started pulling out moss and grass and dumping the pieces over the side of the nest. Throughout that night, halting at intervals when the flash light glared, the spider dug; and again, the second night. After sixteen and a half hours of labor, she had made a nest eight inches deep, complete with a door.

These doors are marvels of mechanics. Passmore showed me pictures that reveal them under construction, as the spider heaps up a small amount of earth in the form of a disk and adds earth and webbing until it is half large enough to fill the entrance. She then pulls it down from its vertical position, leaving it hinged at one side by webbing, and proceeds to add web and earth until it fills the entrance. Finally, she bevels the edges and obtains a tight fit by repeatedly pulling the door up and down while it is yet moist. The completed job resembles the top of a valve in a gasoline engine.

From trapdoor spiders, Passmore continued his search for even more dramatic subjects. He made one of his most interesting finds recently while excavating a tarantula nest. Armed with pick and shovel, he cut away a large section of earth to disclose the burrow in profile. Measurements revealed that the nest had been cut straight down eight inches from the surface, then at a right angle, fourteen inches from the vertical section.

With his camera set up in the freshly dug pit to record whatever he might find as he chipped away with his miner's pick,

he came upon a most unusual scene: a female tarantula, lying on her back, paralyzed by the sting of a wasp.

Science knows that the tarantula is a fair prey for the wasp, which stings the victim, tows it to its burrow, lays an egg whose larva later will consume the tarantula, and then seals up the entrance with earth. But how tarantulas lay and protect their own eggs was unknown until recently. To his laboratory Passmore carried several tarantulas. He found, one day, that they were spinning a web covering over the bottom of their containers. Seeking the reason, he trained a camera on an open can and waited. As days passed, he discovered that the tarantulas were covering their eggs for protection against parasites. The eggs laid, the webbing was wrapped around them to form the sac. When hatched, the young cut tiny holes through the sac, which resembles a puffball—soft as silk yet tough as cloth—and escaped from their protective covering.

Passmore takes up the trail of an interesting subject on the slightest provocation, and follows that trail until he learns the complete story. On one occasion, a neighbor's curiosity set him on the track of an unusual bug, in a study that saw him journeying almost daily for two and a half years into the nearby gorge which the San Diego River has cut between stone walls on its course to the sea.

He came in one night with Mrs. Passmore after a day spent photographing scorpions in the back country, to find by his front door a quart jar containing



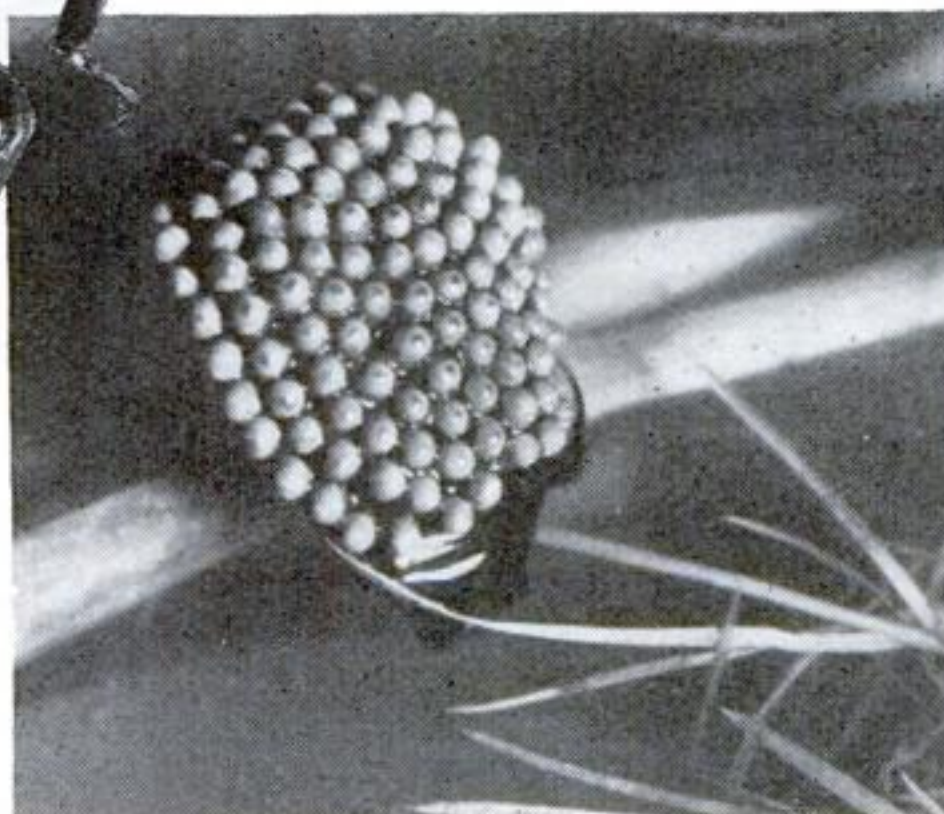
From Passmore's "rogues' gallery"—a wolf spider

a single bug. No note of explanation had been left by the visitor. Next morning a voice on the telephone told him that the strange creature had been found in Mission Gorge. An hour later, Passmore, in company with Clinton G. Abbott, director of the San Diego Natural History Museum, was looking at similar insects in the cases of that institution. "Giant water bug," Abbott pronounced, after a brief comparison.

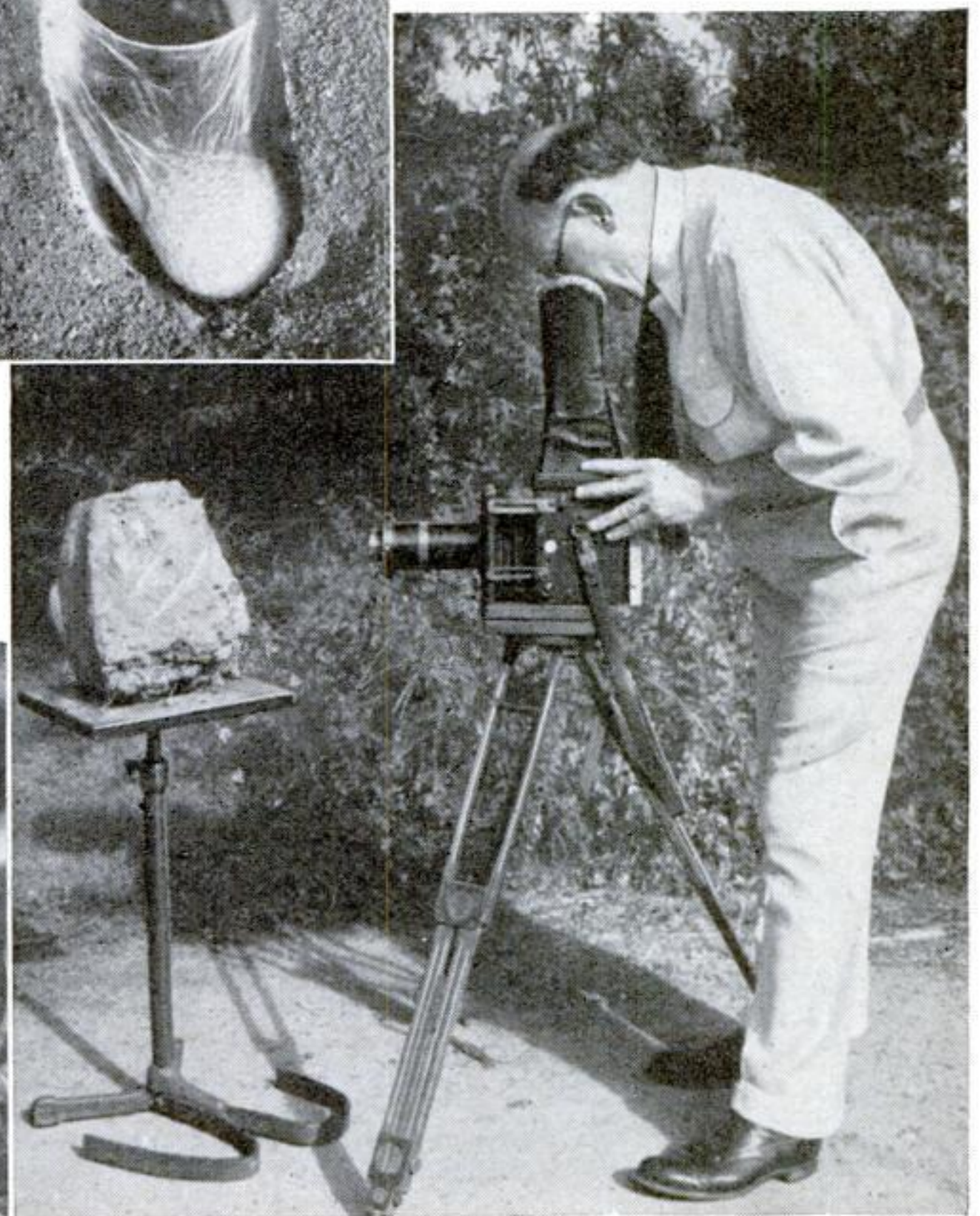
(Continued on page 124)



The male water bug, above, is a walking incubator for eggs which the female lays on his back. The one seen at the right is loaded down with 109 eggs which he will carry until they hatch out



Interior of a trapdoor spider's nest, showing an egg sac. Passmore makes pictures like this by digging up chunks of earth, exposing one side of the burrow, and photographing it as shown at the right



Circus Scout

FINDS NEW THRILLS FOR THE BIG TOP



Con Colleano, king of the tight wire. Novel stunts are constantly demanded

SEARCHING the four corners of the earth for new and sensational acts for American circuses is the interesting occupation of Pat Valdo, once a leading clown of the big tops.

During the summer season, Valdo is superintendent of personnel for the Ringling Brothers and Barnum and Bailey circus. He employs performers and keeps a watchful eye on the show every day.

But, during the winter months, he travels thousands of miles from one continent to another, in the never-ending quest for acts more spine-tingling than those currently thrilling millions of circus-goers.

Valdo, the clown, became Valdo, the maker of circus stars, five years ago when he made his first foreign tour in search of talent. Behind him was thirty years of experience as a clown, a juggler, and a tight-wire performer. And he has that rare ability to anticipate the swiftly changing whims of the public that is called showmanship.

When I met this connoisseur of circus acts, he was sitting under the canopy of his dressing tent with the big show in a southern Oklahoma city, reading a foreign theatrical magazine.

"I'm working on my next winter trip abroad," he said, explaining that he scans dozens of foreign trade papers to learn what new acts are available in foreign lands. In addition, he receives many letters and calls from friends, in and out of the show business, who have seen acts they think may interest him.

The reason for Valdo's job is the current trend in circus entertainment, he told me. "There was a time when ability was the only prerequisite for a center-ring spot," he said. "But nowadays, it is different. There is a demand for youth and beauty. Circus audiences have become as critical as movie audiences. They want their stars to have personality and be easy on the eyes. So it is quite a job to supply suitable new acts and actors at frequent intervals."

When Valdo goes abroad, he can always depend upon leading European circuses—such as Bertram Mills's and Lord John Sanger's in London, Circus Busch in Berlin, Cirque Medrano in Paris, and Circus Schumann in Copenhagen—for fine exhibitions. Rarely does he fail to find one or more acts he wants in each of

these shows. But he never overlooks the music halls, the tiny wagon shows that tour the countryside, and the wandering bands of acrobats who eke out an existence by passing the hat after village-square performances.

The mere fact that an act is a sensational hit in London or Berlin does not mean that it would meet a similar response in New York or Chicago, and

therein lies the secret of Valdo's success—the knowledge of the requirements for American circuses and the types of acts that Americans want to see.

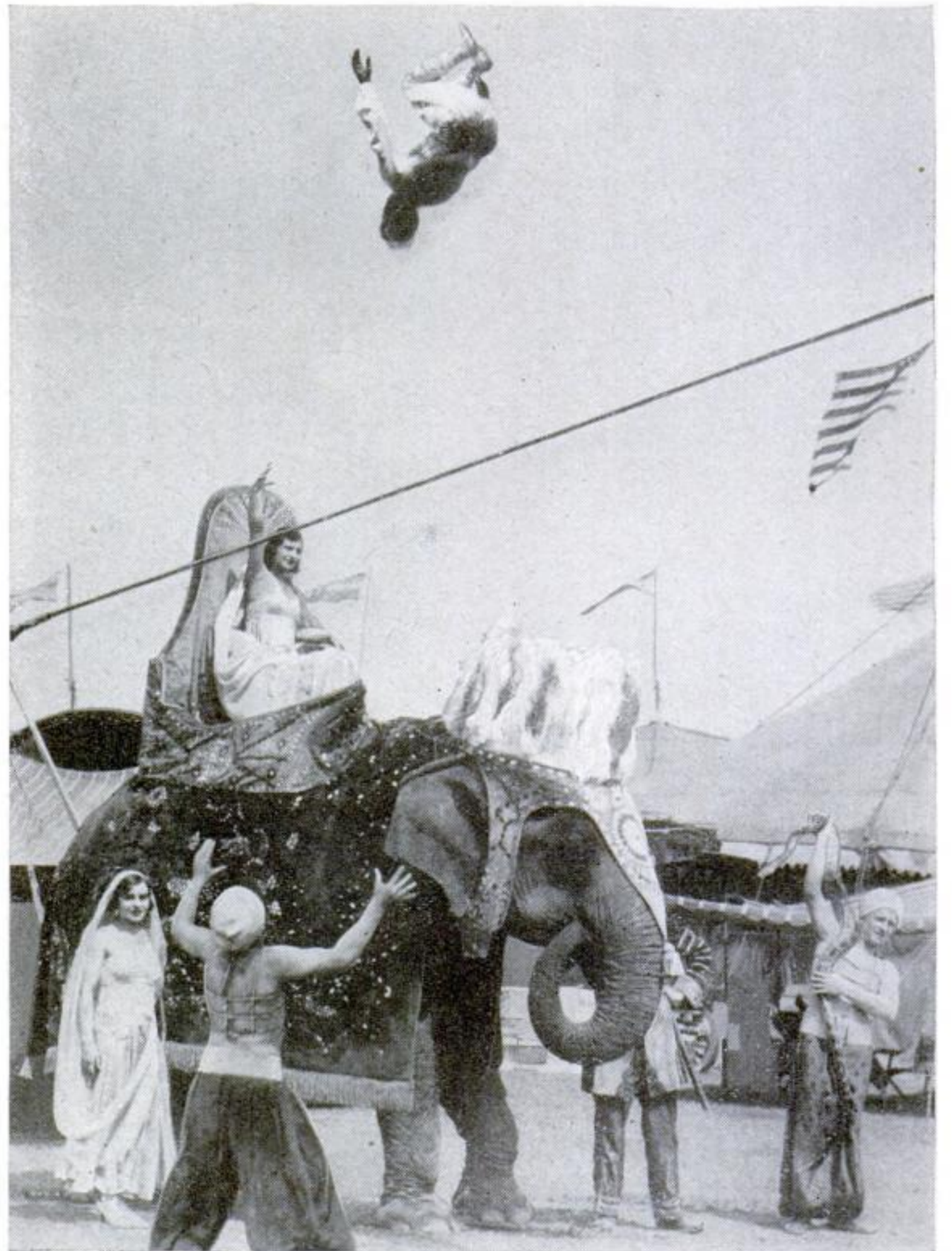
"I saw a troupe of five girls who perform on the Roman rings in Copenhagen," Val-

do said. "They exhibited marvelous strength, skill, and grace, and their act was different, but I knew at once they wouldn't do for America, because they stood on the ground and reached for their rings. In this country people expect to see aerial acts thirty or forty feet in the air. If those girls could elevate their rigging, they might be enthusiastically received over here."

And the very bigness of American circus tents robs some brilliant performers of the opportunity to become stars in this country, Valdo points out, citing as an example a juggler he saw in Budapest.

"He was a very clever fellow and I thought his tricks marvelous. But he juggled such small objects as tennis balls, canes, and hats. I realized his act would be practically lost in one of our circus tents with the spectators a hundred feet away and half a dozen other acts clamoring for attention."

Strangely enough, despite their demand



An elephant adds an unusual touch to this tight-wire act. At the left are the Walkmirs in their remarkable perch-pole performance. Two girls whirl around on bars at the top of a pole balanced on the man's head

By A. MORTON SMITH



Mlle. Gillette in midflight in her sensational "broken trapeze" trick, which always makes spectators gasp

for death-defying feats, American circus crowds do not always single out the most difficult tricks for their acclaim, and therein lies another problem for the circus scout. Valdo told me the story of a puzzled Argentine teeterboard acrobat. It seems that this man had for years concluded his act with a triple somersault from a teeterboard to a chair on the shoulders of a companion, and always received an ovation. Feeling that the trick would lose its prestige and that he should do something more difficult, he began work on a quadruple somersault. He mastered the trick after breaking his nose in one faulty landing. But he was amazed to find that spectators did not receive it with the applause that marked his previous efforts. He came to Valdo with his problem.

"I discovered," Valdo said, "that the acrobat lost so much height in doing four revolutions that he completed the last one only four feet from the ground, and the catcher was forced to go down on his knees to complete the trick. The close proximity of the acrobat to the ground and the awkward position that the catcher had to assume left an impression on the spectators that the feat was mediocre."

Asked if there is really anything new so far as circus acts are concerned, Valdo replied emphatically that there is.

"Circus men had often told me," he said, "that there was nothing new possible in bare-back riding—that old-time riders had accomplished every trick possible. That seemed to be true for a number of years so far as America was concerned."

But Valdo had heard of the Cristianis, an Italian family of riders. When he went to London, he inquired about them, but was discouraged on every hand.

"They are good riders, yes," a London showman told him, "but their wardrobe is terrible."

"That did not deter me," Valdo



And here is Pat Valdo himself, creator of circus stars. He is seen with Mlle. Gillette, one of his most famous "finds" from Europe

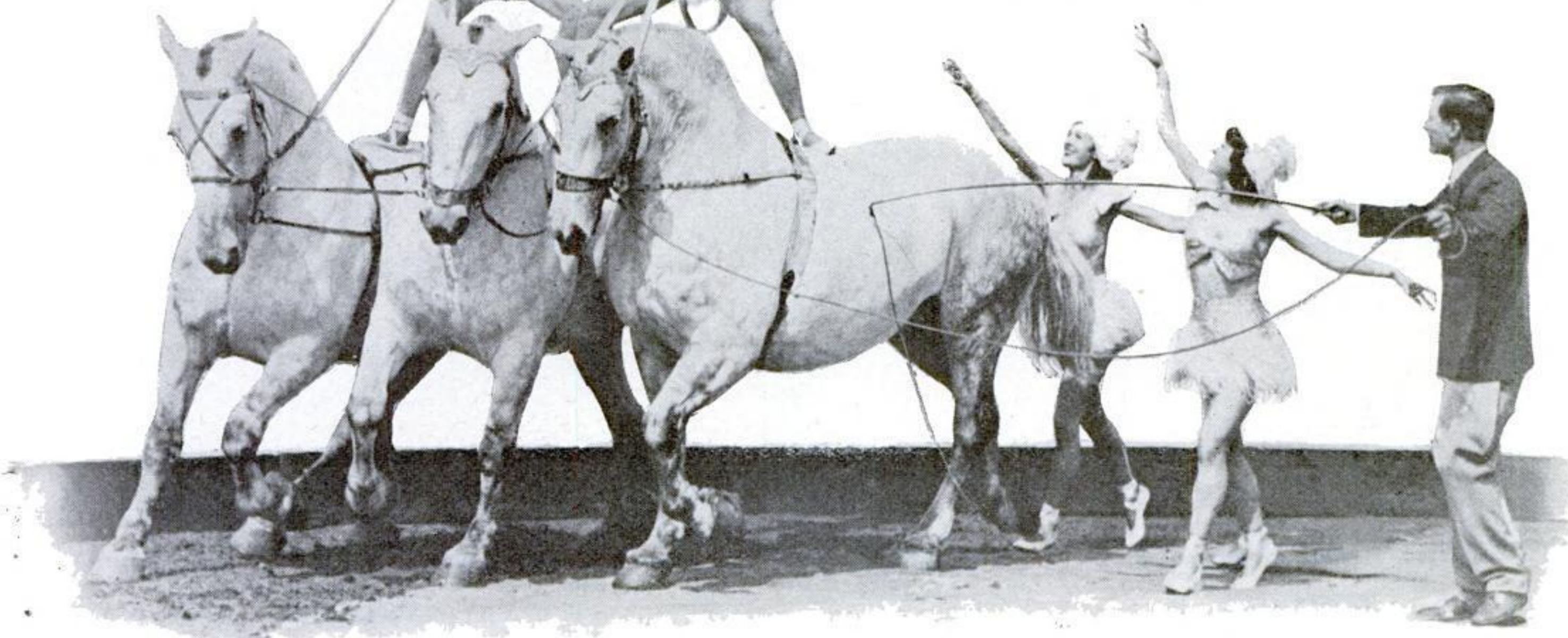
said. "I went to Brussels as soon as I could get there. I arrived one night, too late to catch the show. But I persuaded the Cristianis to go through their act at midnight for me. I was so pleased that I stayed with them until dawn and came away with a contract in my pocket."

The Cristianis have shown American audiences hitherto-unheard-of feats on horseback, the circus scout declared. Lucio Cristiani stands on the back of one cantering horse, his feet tied together. He leaps into a backward twisting somersault, at the same time passing his body through a hoop, and lands standing on the back of another horse, despite the hobbles. According to Valdo, no other bare-back rider has accomplished such a feat.

A few years ago, perch-pole acts had gotten into a rut, Valdo said. Most troupes were doing the same routine. One performer held a perch pole in a belt pocket or on

(Continued on page 108)

When Valdo saw the Loyal-Repenski riding troupe in London, he lost no time in signing them for an American appearance. Here they are forming a pyramid on three horses



Strange Oil-Hunting Craft

RUNS ON LAND, WATER OR MUD

ABOARD a fantastic-looking vehicle that traverses land, water, or marshland, surveyors and prospectors of the Gulf Oil Company are exploring the Louisiana coast in quest of new oil fields. Half rolling, half floating on ten-foot tires, the amphibian carries them safely and speedily through veritable jungles of marsh grass whose conquest has awaited the

coming of the new amphibian "tank."

Automobile, tractor, and boat rolled into one, the hybrid vehicle looks like an inventor's nightmare—but it works! When it is on dry land, its huge pneumatic tires, the biggest ever molded, cushion the shocks of rough terrain. In the water they act as floats, providing so much buoyancy that the weight of the 7,500-pound machine scarcely wets them to the rims. Rubber cleats hooked about them like tire chains, twelve to each wheel, serve as paddles for aquatic travel and aid traction in slippery mud.

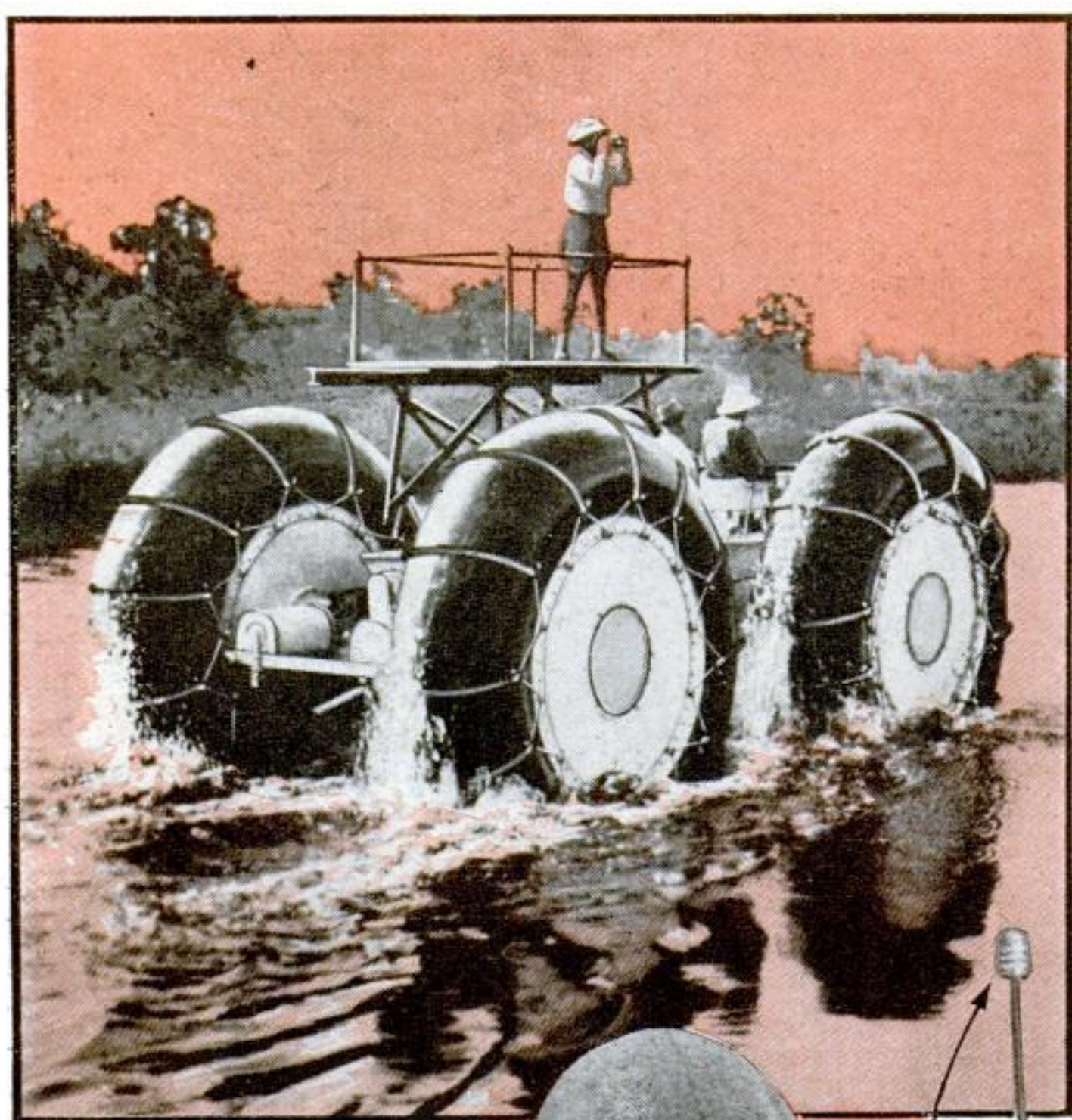
Advance parties of surveyors use the "marsh buggy," as oil men have christened it, in surveying and mapping a region to be explored for possible sources of petroleum. Then prospectors load their equipment aboard it and get to work. They are among the 260 field crews currently

searching for new American oil fields by means of geophysical prospecting, the modern, scientific way of plumbing the earth's crust for hidden mineral riches.

No longer are oil wells sunk hit-or-miss, with a waste of time and labor each time a "dry hole" results. Before a drill point even scrapes the earth, sensitive divining instruments now explore the underground structure of the rock and show where oil is likely to be found. A good place to see how they work is the gulf-coastal plain of Louisiana and Texas, where they have proved conspicuously successful by locating more than 100 new oil fields.

Here oil occurs in the neighborhood of curious subterranean formations known as "salt domes"—great masses of rock salt, thousands of feet in diameter, rising from unfathomed depths to within a mile or less of the earth's surface. While geologists are not in complete agreement as to how they got there, the important thing to oil men is that they produced enough of a subterranean upheaval to bulge the overlying rock into huge arches. Oil seeping upward through subsequent ages became pocketed in the rock layers that form the sides and cap of many of these domes, forming vast pools of trapped petroleum. Though not an infallible sign of oil, a salt dome is therefore a promising place to look for it.

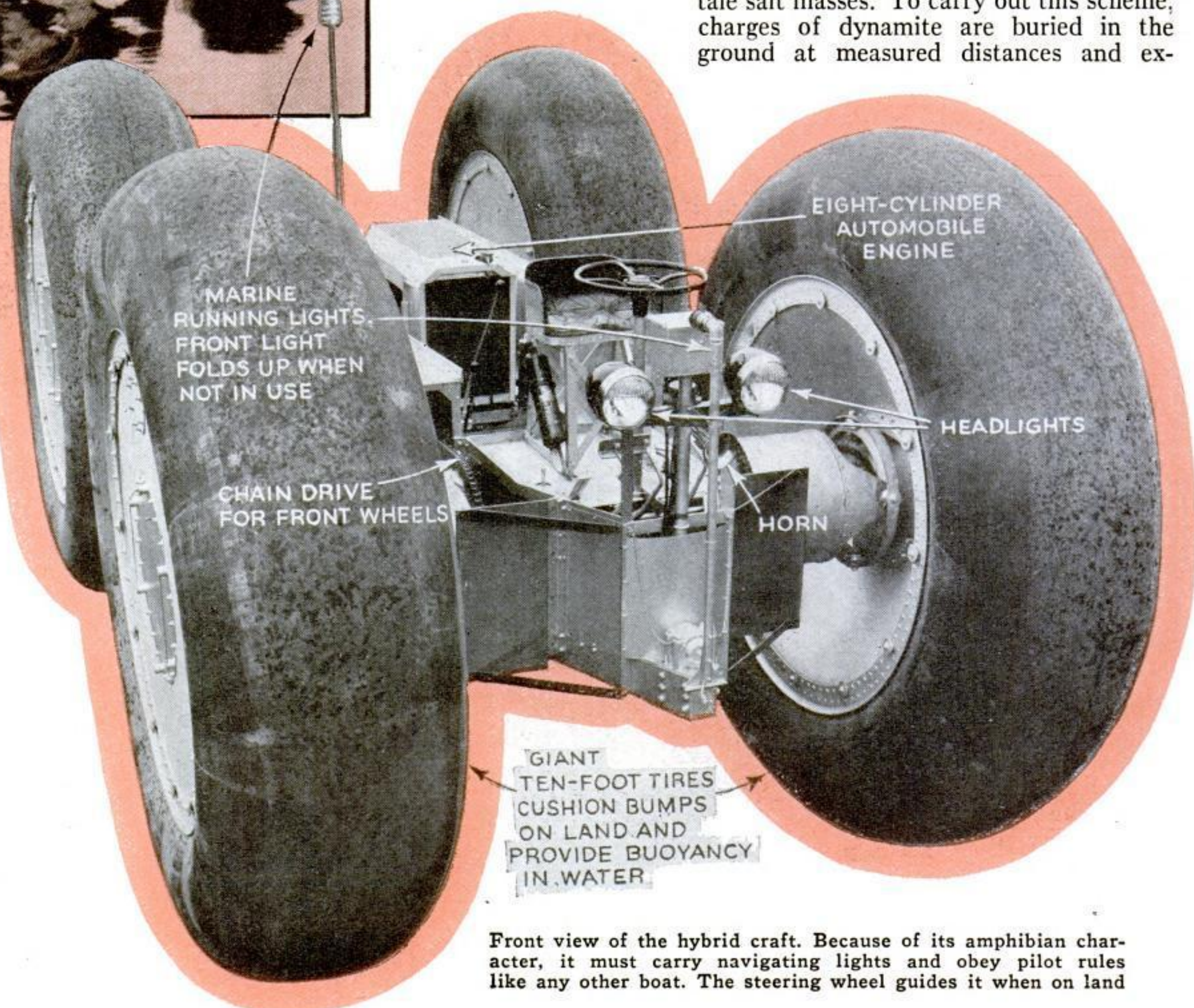
In one method of geophysical prospecting, artificial earthquakes reveal the tell-tale salt masses. To carry out this scheme, charges of dynamite are buried in the ground at measured distances and ex-



The "marsh buggy" afloat. The giant tires provide buoyancy, and cleats give traction in the water

*Prospecting Crews
Navigate Swamps
In a Hybrid "Tank"
That Transports
Modern Divining
Instruments for
Scientific Tests*

By
**GROVER C.
MUELLER**

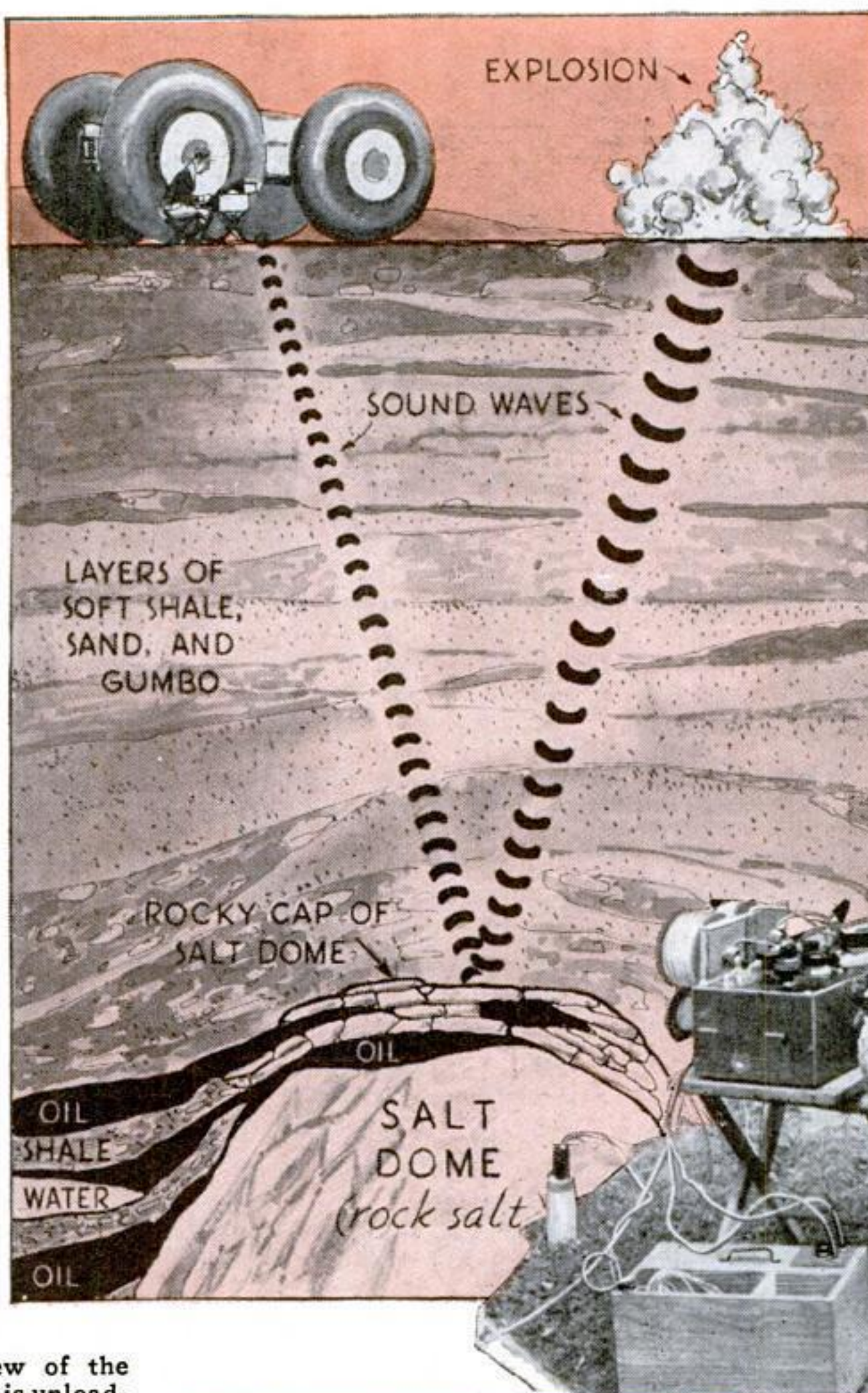


Front view of the hybrid craft. Because of its amphibian character, it must carry navigating lights and obey pilot rules like any other boat. The steering wheel guides it when on land

ploded. Seismographs or earthquake-detecting instruments time the interval between each explosion and the arrival of the reflected tremor that rebounds, like an echo, from the underground rock. The longer it takes to return, the deeper the rock must lie at that particular point. Much as the ocean floor is charted by "echo sounding," the contour of a hidden rock layer is mapped and the bulges that mark salt domes are detected.

Geophysical prospecting provides another way, too, of finding the salt domes. Like lumps in mashed potatoes, they differ in density from the surrounding bed in which they occur. The result is a faint but measurable difference in the force of gravity above the domes, causing a variation in the "pull" of the earth on any objects immediately above them. Thus, by noting slight changes in the apparent heaviness of a weight hung from a spring balance, at different points on the earth's surface, the underlying rock can be "weighed" and the oil-bearing formations located. Of course, no ordinary spring scale will do; the instrument actually used, called a gravimeter, must be so sensitive that it can detect variations in weight of less than one part in 10,000,000! In a typical model, the instrument is housed in an air-tight case so that changes in atmospheric pressure cannot affect it, and the indicating pointer is a beam of light seen through a microscope eyepiece.

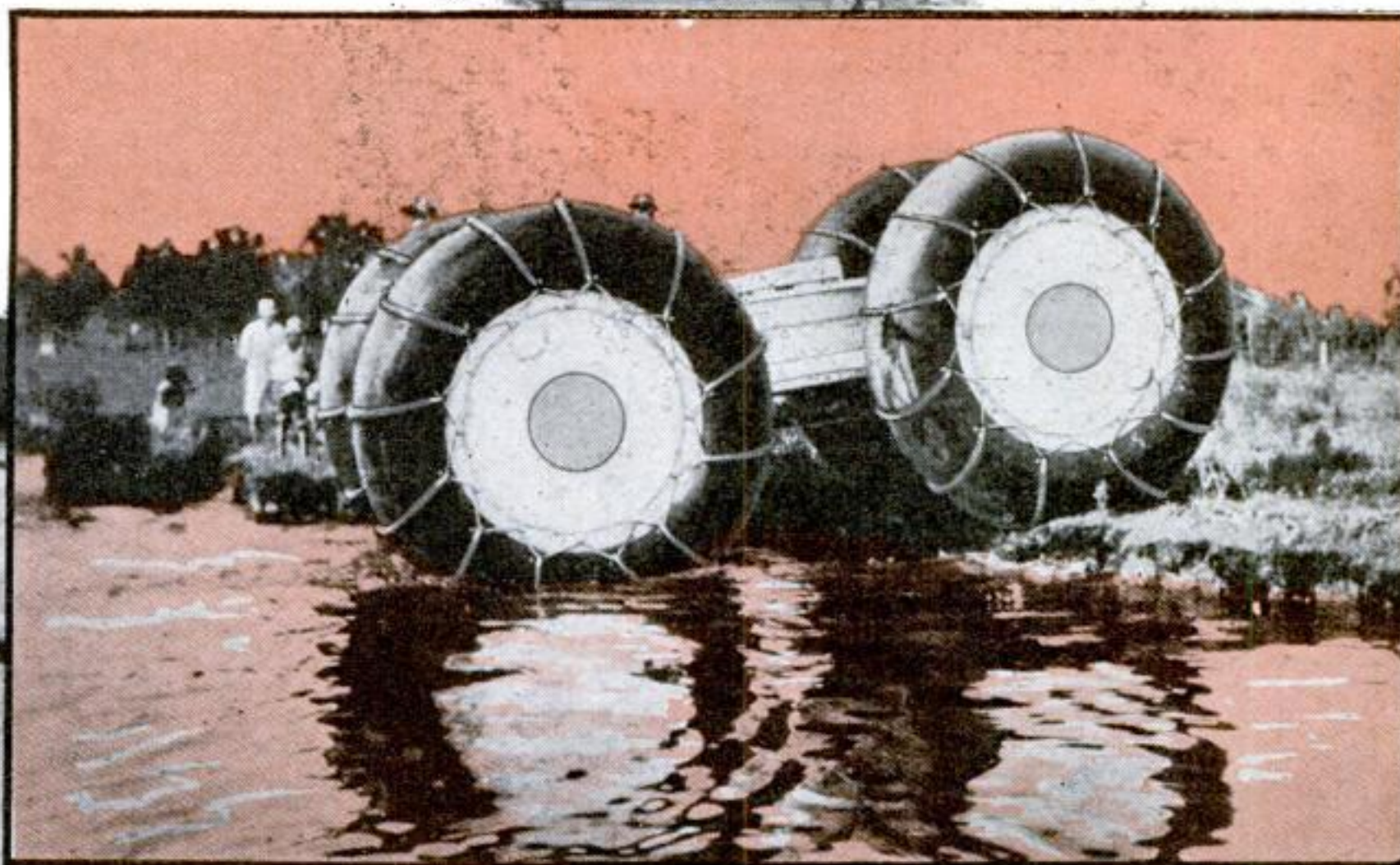
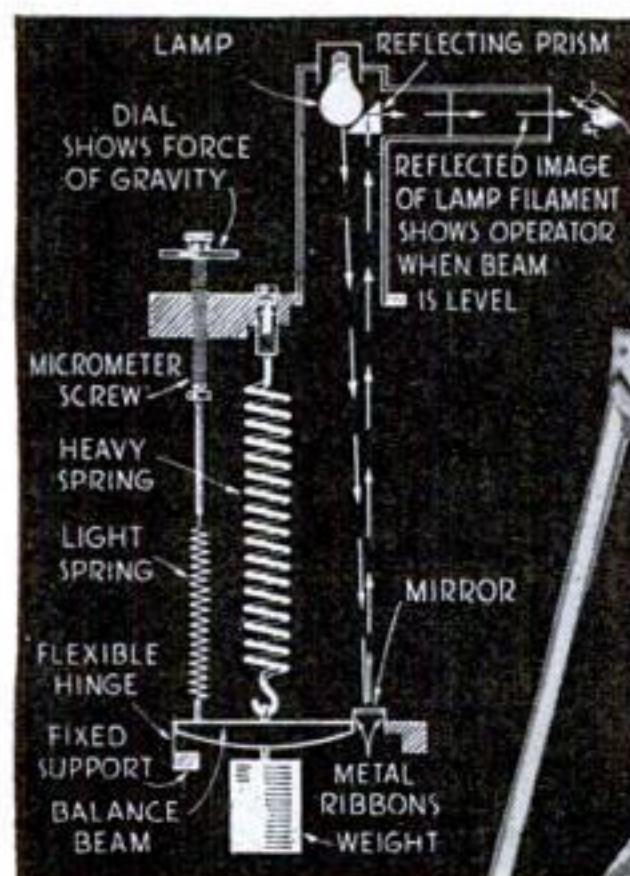
This "gravity" method is the one currently employed by the crew of the "marsh buggy." Accompany them to a prospecting site, and you



HOW ECHOES CAN PLUMB THE EARTH

Man-made earth tremors, reflected from underground rock layers as shown in the drawing at the left, reveal "domes" that may hold oil. Below, a small seismograph that records the rebounding vibrations

Below, the crew of the "marsh buggy" is unloading a delicate instrument that measures faint variations in the force of gravity. Drawing at left shows how it works. Right, the "buggy" going ashore



will see them slide the 100-pound gravimeter off the rear of the machine. Gently they lower the delicate instrument to a built-up foundation of wood or metal, steady enough to hold it level in the marsh during the brief time required for a reading. The leveling is the most time-consuming part of the task; when it is done, the actual observation takes but a moment, and the hybrid tractor, with the instrument loaded back upon it, rolls away to another site.

As this is written, plans also are under way for providing the marsh buggy with the 1,000-pound

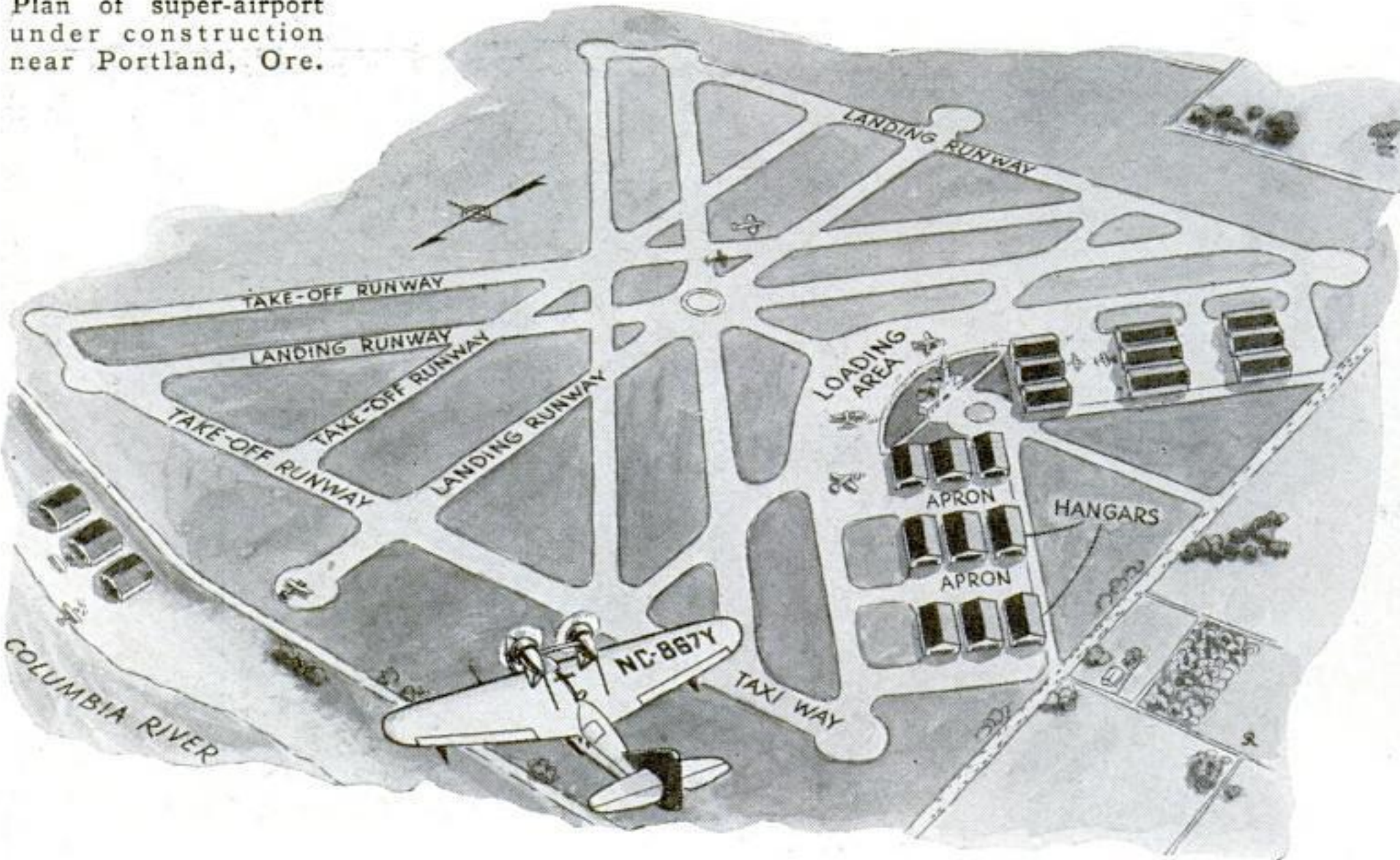
equipment needed for hunting oil by the artificial-earthquake, or "seismic," method. Observations made by the prospectors with the gravimeter and seismographs will check and supplement each other, and the findings will be reported to headquarters and plotted on maps to guide well drillers in choosing likely sites.

The idea of building an amphibian vehicle that would open hitherto inaccessible oil fields to these up-to-date methods of exploration originated with Abbot A. Lane, of the Gulf Research and Development Company. With his startling scheme approved by officials of the firm, he and his assistant, E. W. Jacobson, with other laboratory staff members worked out the plans from which the machine was built at Pittsburgh, Pa. Since nothing like it had ever been constructed before, each detail had to be invented as they went along.

For the power *(Continued on page 132)*

New Super-Airport Has Mile-Long Runways

Plan of super-airport under construction near Portland, Ore.



EIGHT hard-surface runways, each almost a mile long, will form part of a new "super-airport" now under construction on a 700-acre tract of land near Portland, Ore. Located near the banks of the Columbia River, about seven miles from the center of the city, the \$4,000,000 air field will provide adequate facilities for military, commercial, training, and private aircraft of land, amphibian, and water types. Plans call for filling in more than 4,000,000 cubic yards of soil, which will be dredged out of the river, while an elaborate drainage system will keep the port free from pools of surface water at all seasons of the year. An earthen bank three to nine feet high will block floods in the Columbia River. Hangars, shops, administrative buildings, lighting systems, and paving are planned to meet the estimated air-traffic conditions of at least twenty years hence.



REFRIGERATING DEVICE MAKES RIBBONS OF ICE

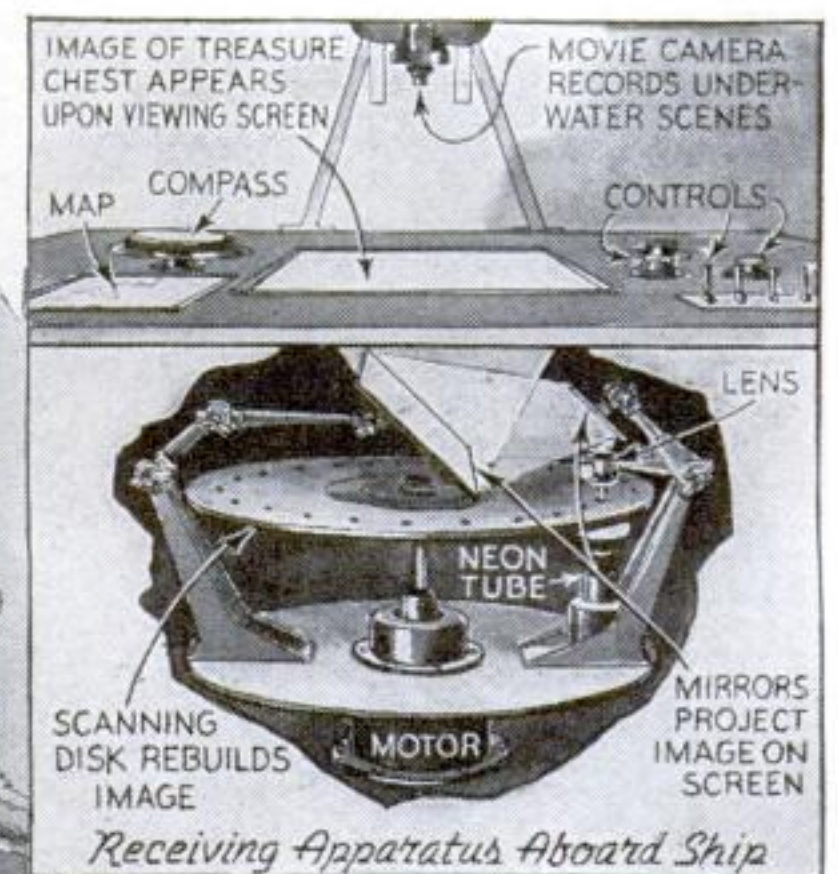
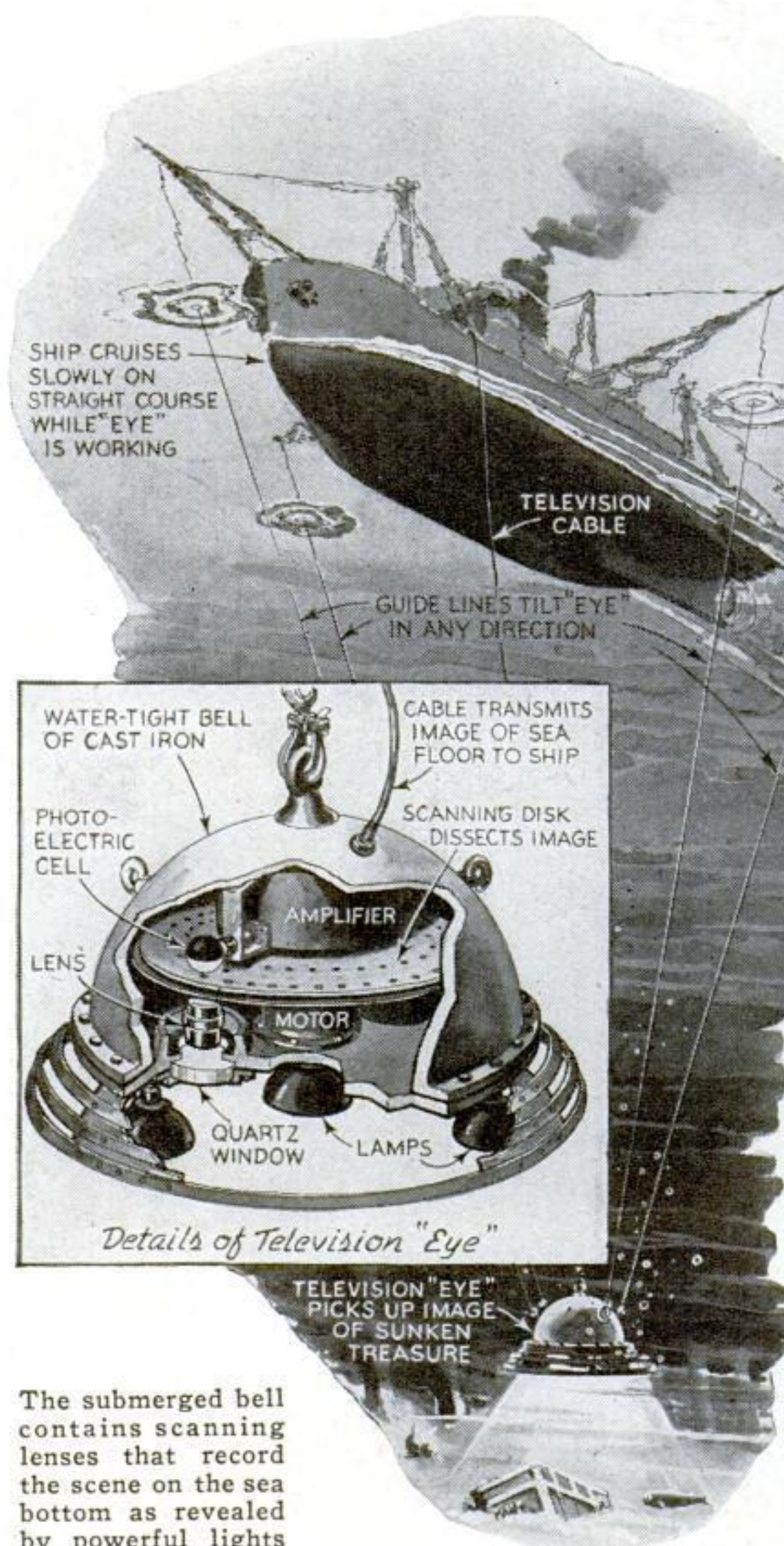
RIBBONS of frozen water stream out of a new ice-making machine just marketed. Formed on a revolving cylinder in the refrigerating apparatus, the ice breaks off automatically and comes out in flakes an eighth of an inch thick, one inch wide, and four inches long. Because of their curved shape, the flakes do not freeze into a solid mass, and they are said to have greater cooling value than ice in other forms.

DOG HARNESS PROVIDES HANDLE FOR CARRYING



A NOVEL harness for small dogs makes it easy for their owners to carry them across dangerous highways and street intersections. Made of leather, the harness consists of straps encircling the dog's body and joined over his back by a carrying handle. A leash can be snapped onto the harness.

TELEVISION "EYE" SCANS OCEAN FLOOR



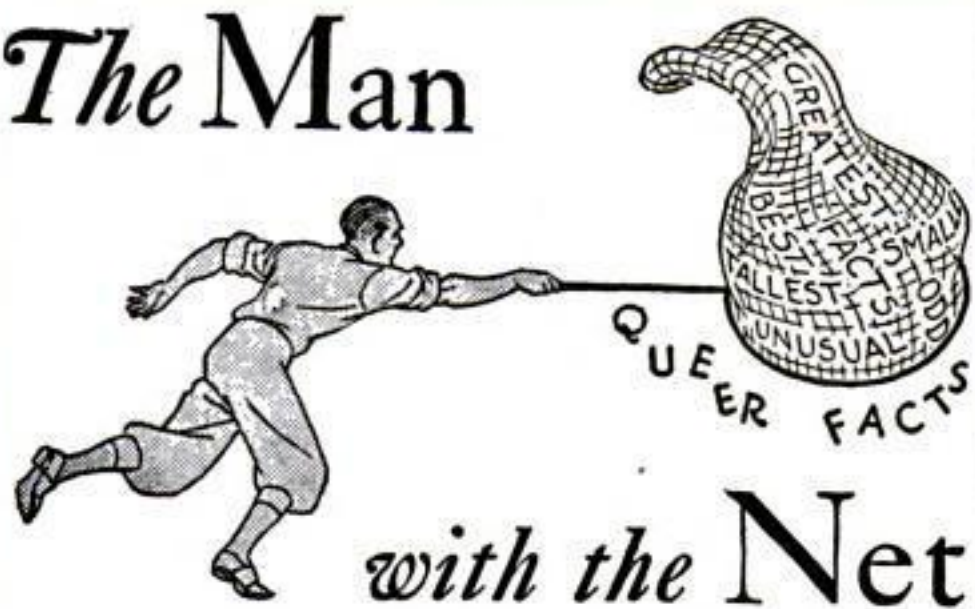
Aboard the exploring vessel, a television receiving unit projects an image of the ocean floor on a screen

Lowered from an exploring vessel to within a few feet of the bottom, the subsurface "eye" is inclosed in a water-tight scanning bell which can be tilted in any direction by manipulation of its four supporting cables. Powerful searchlights shine through heavy quartz windows to illuminate the sea floor so that objects can be clearly distinguished by the two sets of scanning lenses mounted within the cast-iron bell housing. Images of the ocean bed picked up by the scanning units are transformed into electric impulses, amplified, and relayed through a connecting cable to a television receiving unit in a cabin on shipboard. Here the images are recreated and projected from a lens onto a translucent viewing screen with the aid of a system of inclined mirrors. Permanent film records of the televised views will be made by photographing the viewing screen with a movie camera. The apparatus is expected to eliminate the danger and reduce the cost of present underwater exploration methods.

The submerged bell contains scanning lenses that record the scene on the sea bottom as revealed by powerful lights

SCANNING the ocean floor for wrecked ships or sunken treasure, an underwater television eye proposed by an Iowa inventor will transmit images of the sea bed to a receiving unit on the surface, making deep-water explorations possible.

The Man

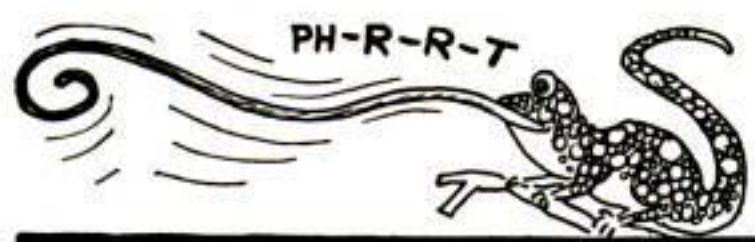


with the Net

ICE freezes thicker at zero degrees F., than it does at temperatures below zero.

MOLASSES, a cheap by-product of sugar refineries, has more food value than the pure crystallized sugar.

CHAMELEONS can extend their tongues to a length greater than their bodies.



MODERN paper-making machines can turn out a mile of paper a minute.

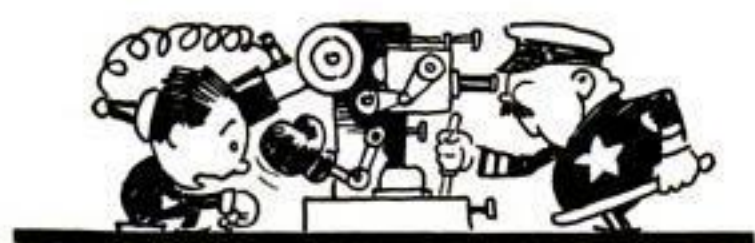
OXYGEN obtained from air is heavier than oxygen taken from water.

GRASSHOPPERS are called "shrimps of the earth" in China, where they are eaten for food.



THUMBS are recognized by the law as being more valuable than fingers. The U. S. Employees' Compensation Commission allows a workman fifty-one weeks' pay for the accidental loss of a thumb but only twenty-eight weeks' pay for the loss of a forefinger.

BRAIN WAVES may be used like fingerprints for identification, tests at the State University of Iowa have indicated.



APRONS made of human bones are worn by Tibetan priests during certain religious rites.

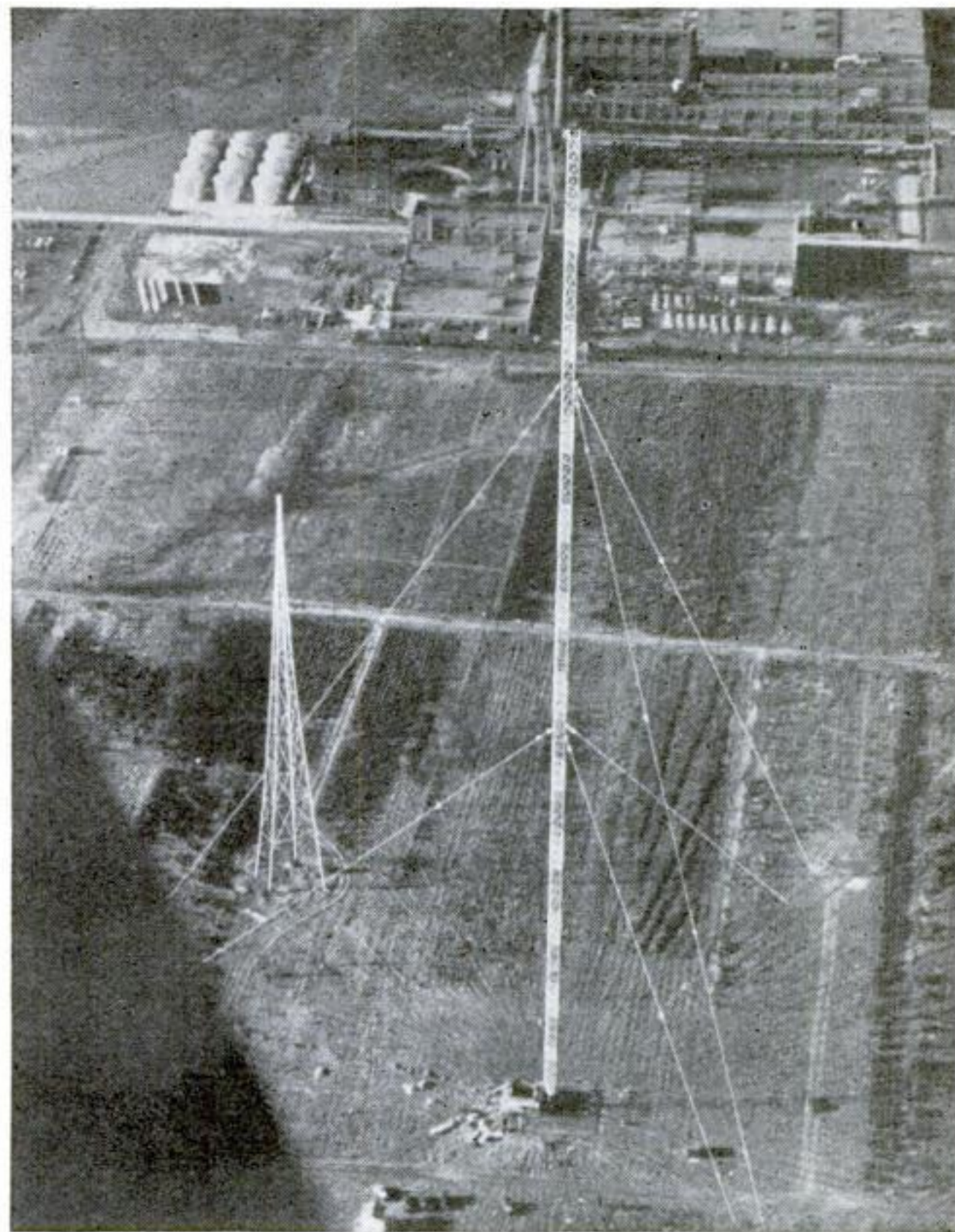
ORANGE pulp is now used in tempering steel.

AUTOMOBILE TIRES equipped with bells that ring if the pressure drops have been invented in England.



RADIO TOWER HAS A HEIGHT OF 640 FEET

ERECTED on a 300,000-pound concrete base, a new radio transmitting tower just completed for a New York broadcasting station stands 640 feet high. The giant mast rests on a porcelain insulator built to bear a maximum weight of over 1,000,000 pounds, while two sets of guy wires capable of withstanding a pull of eighty tons hold the tower in place. The correspondingly elaborate system of grounding consists of 90,000 feet of copper wire buried in a series of trenches that radiate from the base of the tower in all directions. To protect passing airmen, the top of the giant mast is equipped with a flashing airplane beacon whose beam is visible for a distance of almost 100 miles.

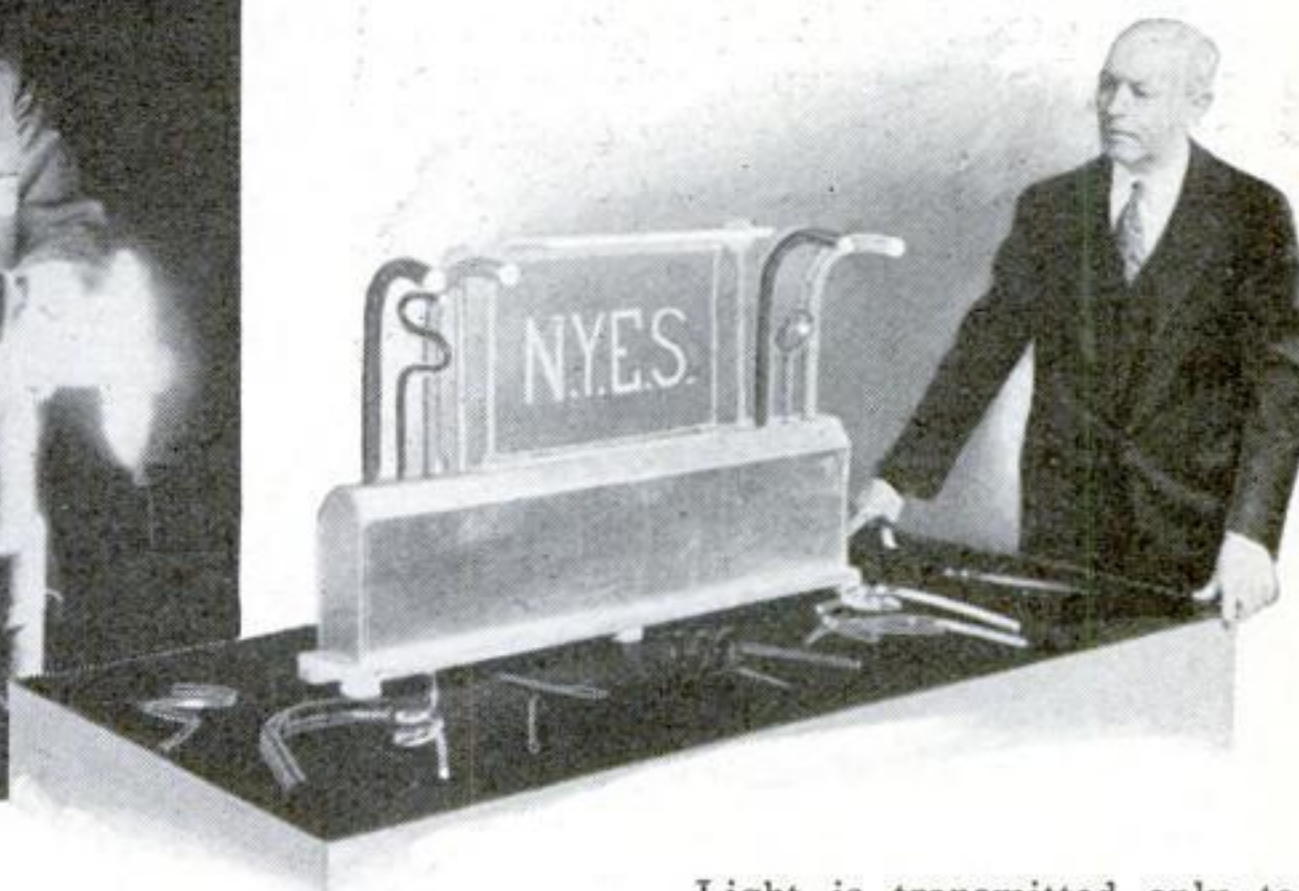


New radio mast, showing radiating trenches dug for ground wires



Exposed to ultra-violet light, rods of the new plastic substance become phosphorescent

NEW PLASTIC PRODUCES ODD LIGHTING EFFECTS



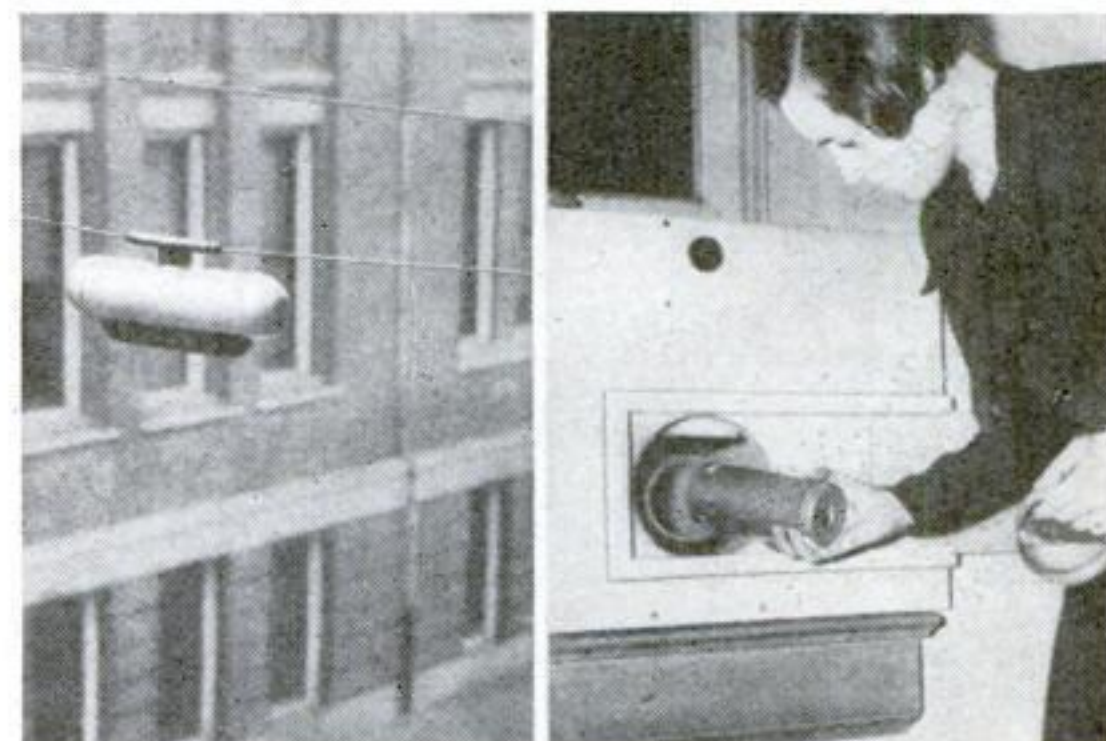
Light is transmitted only to the edges and sunken letters

NOVEL electric signs are among the many possibilities opened up by a new thermoplastic material developed after years of research by Du Pont chemists. Possessing many of the characteristics of natural quartz, the crystal-clear substance has the unusual property of transmitting light from one edge to another, even

around a bend, without the sides lighting up. Another curious trait is that a rod of the plastic turns into a phosphorescent wand after exposure to ultra-violet light. Capable of being cut, sawed, drilled, and molded, it is expected to prove useful in making instrument panels, tubing, candlesticks, and other products.

MECHANICAL PIGEON CARRIES MESSAGES

SHUTTling between two buildings, a mechanical "carrier pigeon" transports messages for faculty members of the Harvard School of Engineering. Running on cables, the robot messenger consists of a metal cylinder powered by a small motor which stops automatically when the container reaches either terminal. A glowing red light indicates that the cylinder contains a message.



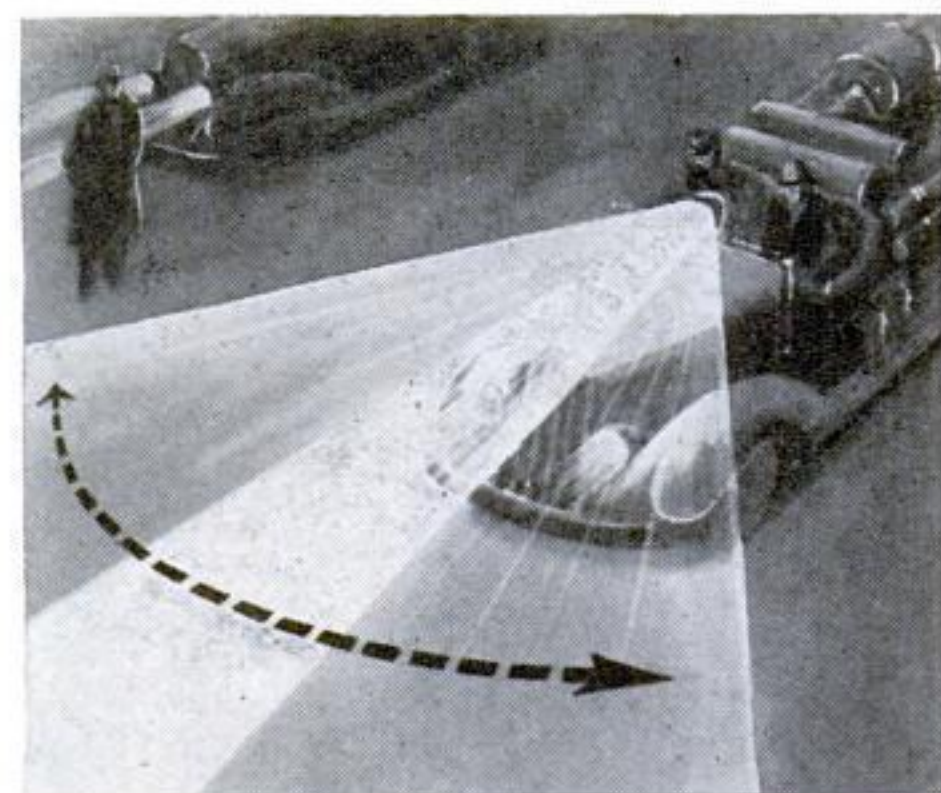
"Pigeon" in flight and, right, a message being inserted

MAN BEATS HORSE IN TEST OF SPEED

Jesse Owens, Olympic track star, at the start of a race in which he outdistanced a fast race horse



A RACE between a man and a horse ended with the honors on the side of the human contestant when Jesse Owens, the Negro track star whose performance won him fame at last summer's Olympic Games, recently demonstrated his sensational fleetness of foot at Tropical Park in Cuba. Proving a forty-yard handicap allotted him was more than he needed, he sprinted 100 yards in less than ten seconds and finished a full twenty yards ahead of the pride of Havana's stables.

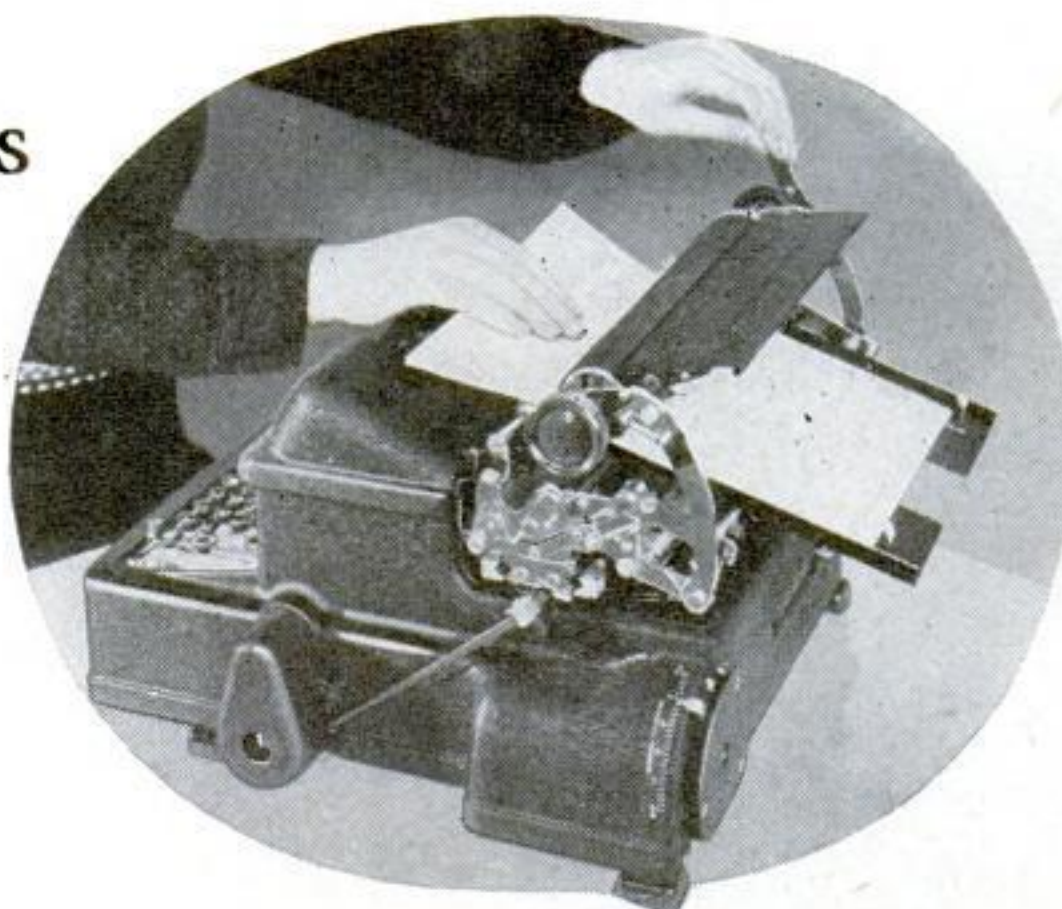


FIRE-TRUCK HEADLAMP WIGWAGS WARNING

BY WIGWAGGING its brilliant red beam from side to side, a new headlamp for fire trucks, ambulances, and emergency cars warns traffic to clear the way. The signal is also visible to pedestrians on both sides of the street, and to cars approaching from a side intersection. An oscillating reflector, motor-driven, swings the beam while the lamp housing remains stationary.

NEW TYPEWRITER FEEDS ITSELF WITH PAPER

SHEETS of paper and carbons, placed on a tray at the front of a new electric typewriter, are automatically snapped into position for writing. Time and trouble are saved, since each sheet is correctly aligned and the nuisance of adjusting it after it has been inserted is eliminated. The self-acting feed is also declared by the manufacturer to prevent stencil sheets from wrinkling, when the machine is used for stencil work.



Operator placing paper in tray of typewriter



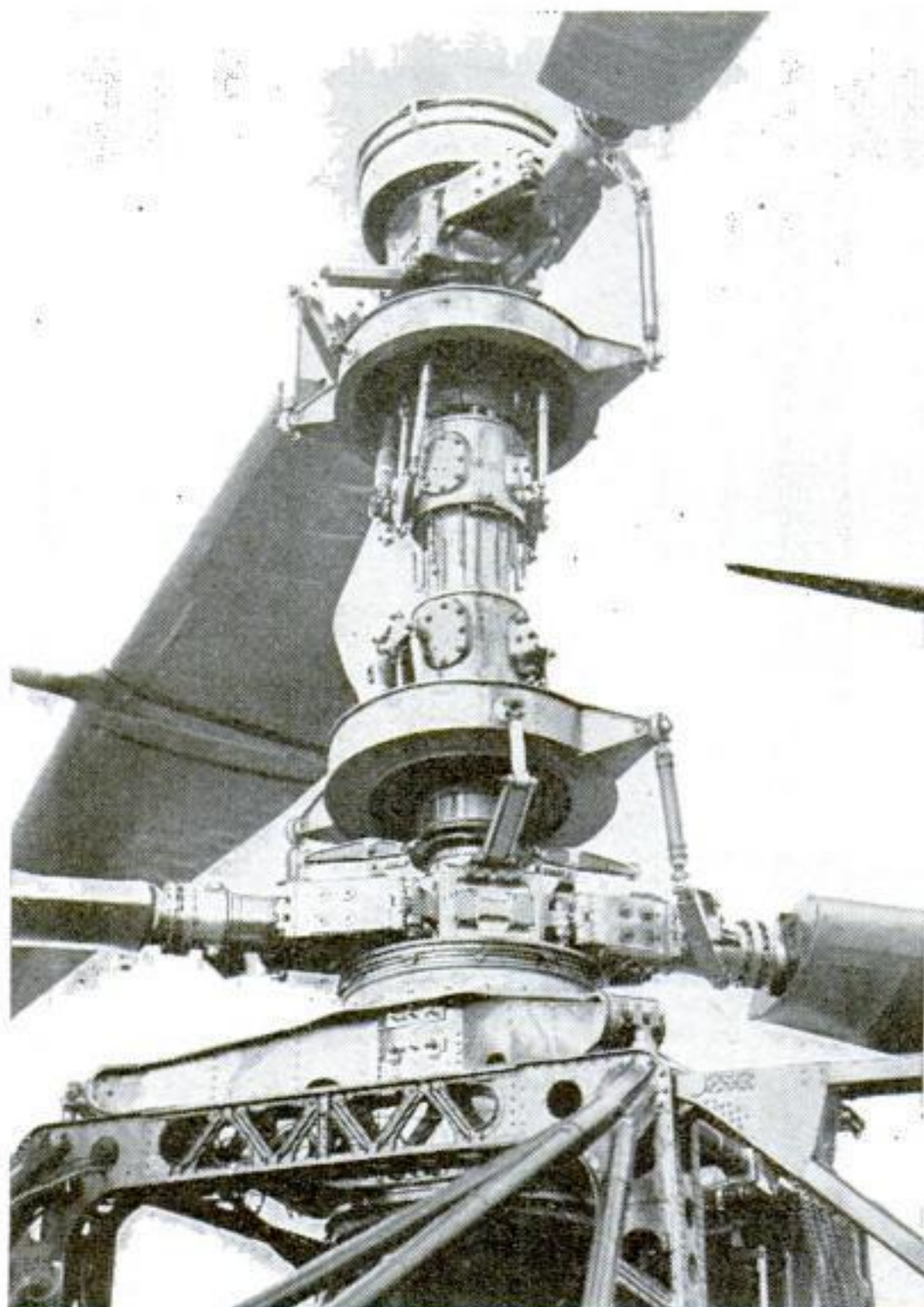
HEAD OF TOOTHBRUSH TURNS ON PIVOT

REVOLVING on a pivot, the head of a new adjustable toothbrush can be locked at a variety of angles, enabling it to reach surfaces of the teeth that are difficult to clean. Setting the head at right angles to the handle provides a convenient implement for massaging the gums.

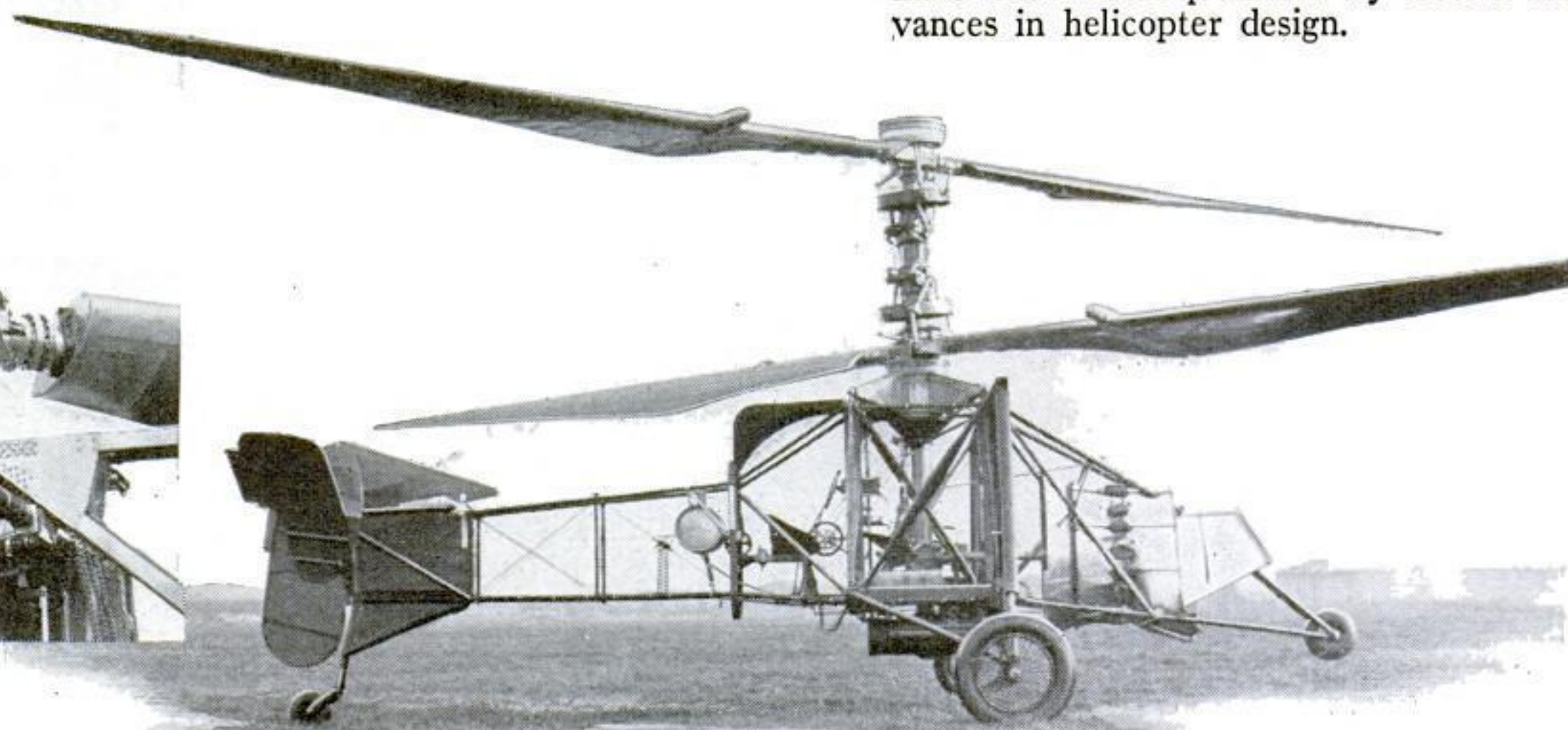
GIANT HELICOPTER TO CROSS OCEAN

PLANS for a giant transatlantic helicopter, capable of flying twelve passengers from New York to Paris in less than ten hours, have just been announced by a French airplane factory. A pair of three-bladed "windmills" of eighty-foot diameter, whirling in opposite directions above the airplane-type fuselage, are to lift and

propel the proposed craft. Rotated by four motors totaling 3,600 horsepower, they will give the vertical-rising amphibian a forward speed of more than 300 miles an hour. A preliminary model of 300 horsepower, but with two-bladed instead of three-bladed "windmills," has already been built to test details of the projected machine, which is declared to have been made practical by recent advances in helicopter design.

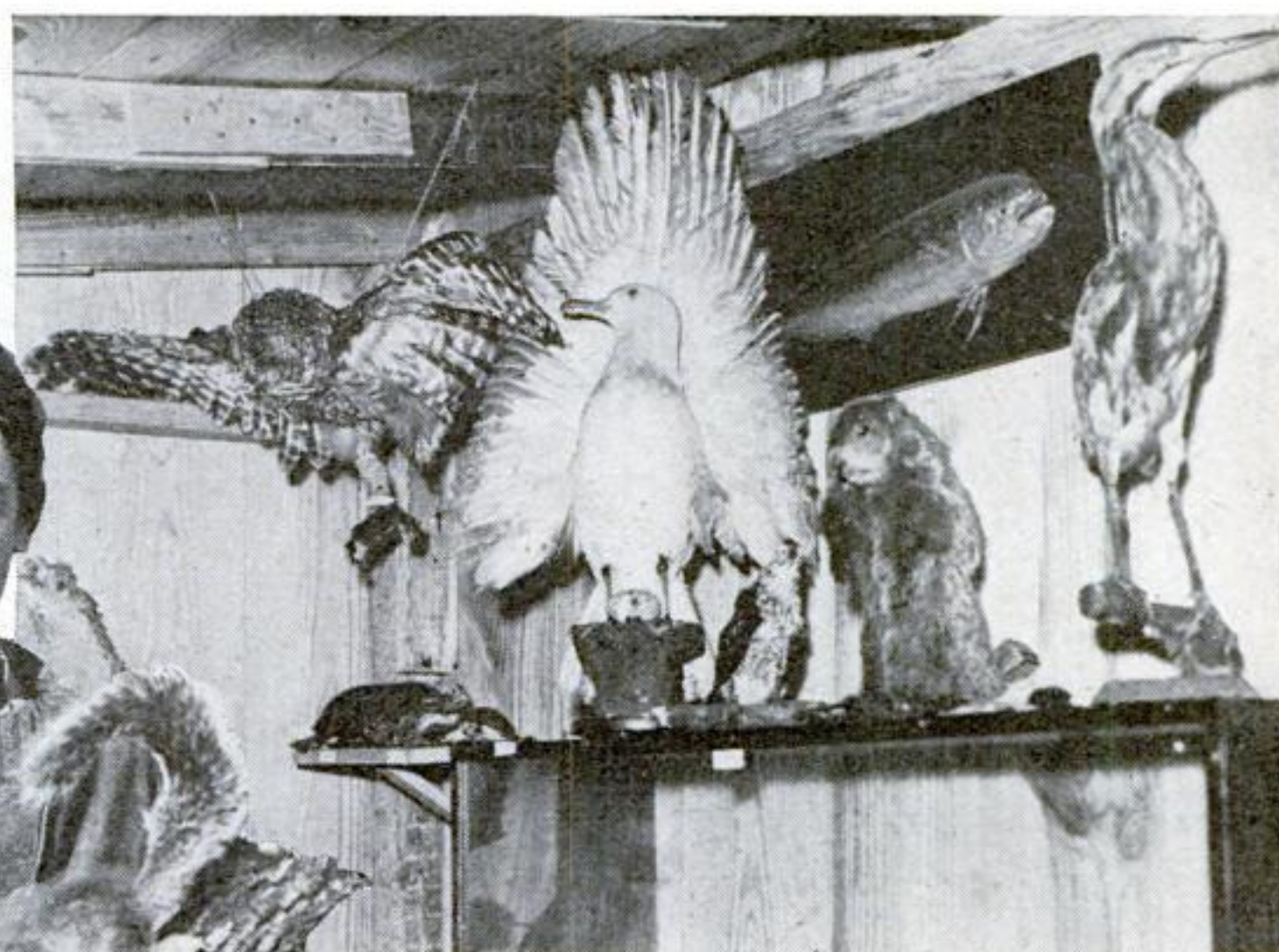


Drive shaft and vanes of 300-horsepower model of proposed helicopter. The model is seen at the right



BOY TAXIDERMIST HAS HIS OWN MUSEUM

Below is Walter Wellborne with one of the 100-odd specimens in his private museum, a corner of which is pictured at the right

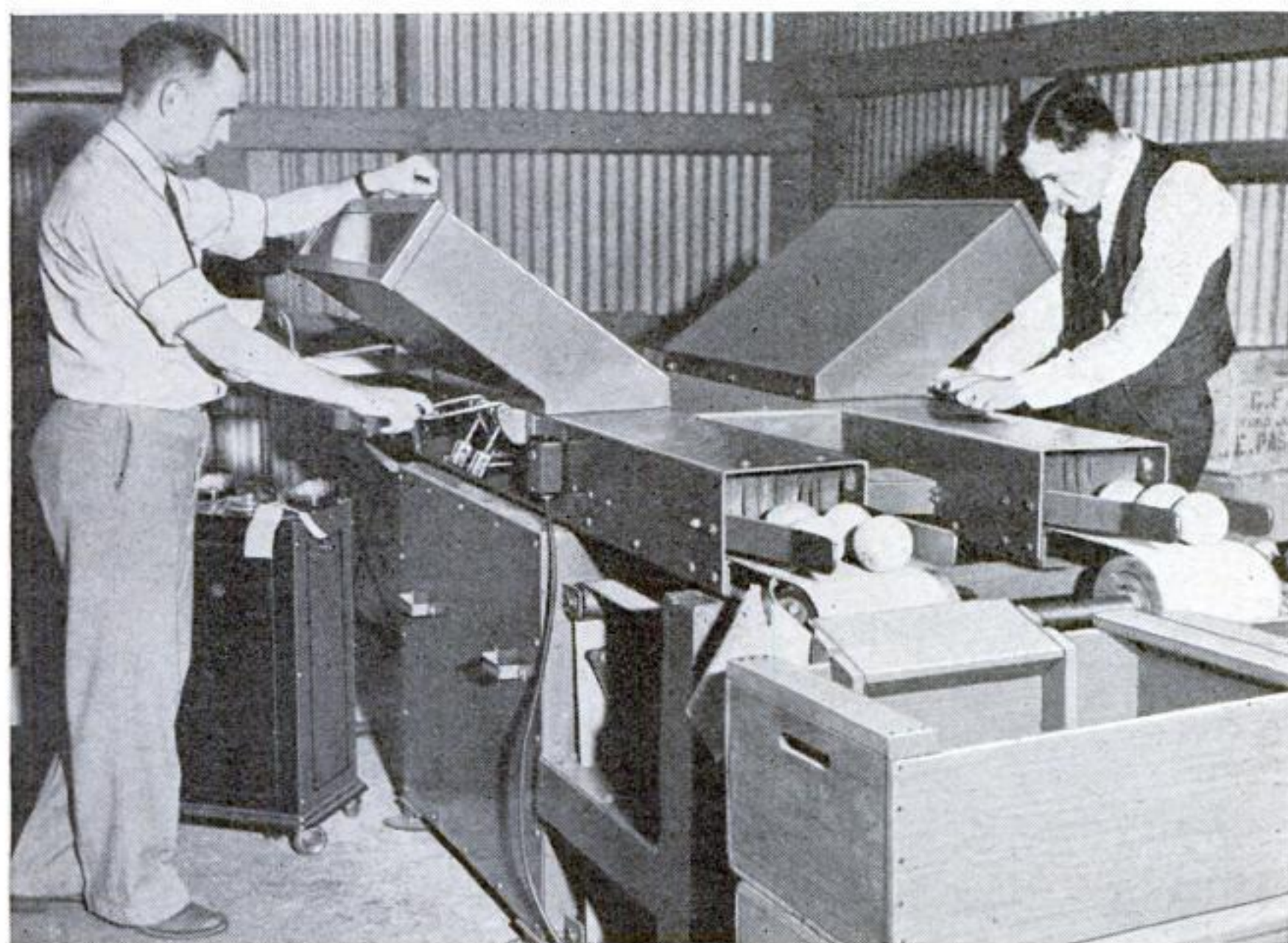


WITH more than 100 choice specimens in his collection, fourteen-year-old Walter Wellborne Jr., of Atlanta, Ga., claims to be the youngest owner of a private animal museum in the world. A skilled taxidermist, he has prepared and mounted more than a quarter of the exhibits himself. Fourteen of his prize trophies were contributed to his collection by the British Museum, in London, England, when he made a visit to that country last summer.



WEIGH BANK CHECKS TO SAVE COUNTING

INSTEAD of counting millions of checks cleared each month, workers in a Los Angeles, Calif., bank save time and labor by putting them on the scales. Weighing 8,000,000 of the oblong slips of paper, the men in the check-distribution department discovered that twenty-two make approximately an ounce, and 350 a pound. That standard now serves for the bank's records. The illustration shows a pile of bundles containing a total of about 2,779 checks being weighed.



Operators watching viewing screens on which X-ray images of oranges appear as they pass

NEW MACHINE X-RAYS ORANGES TO REVEAL FAULTY FRUIT

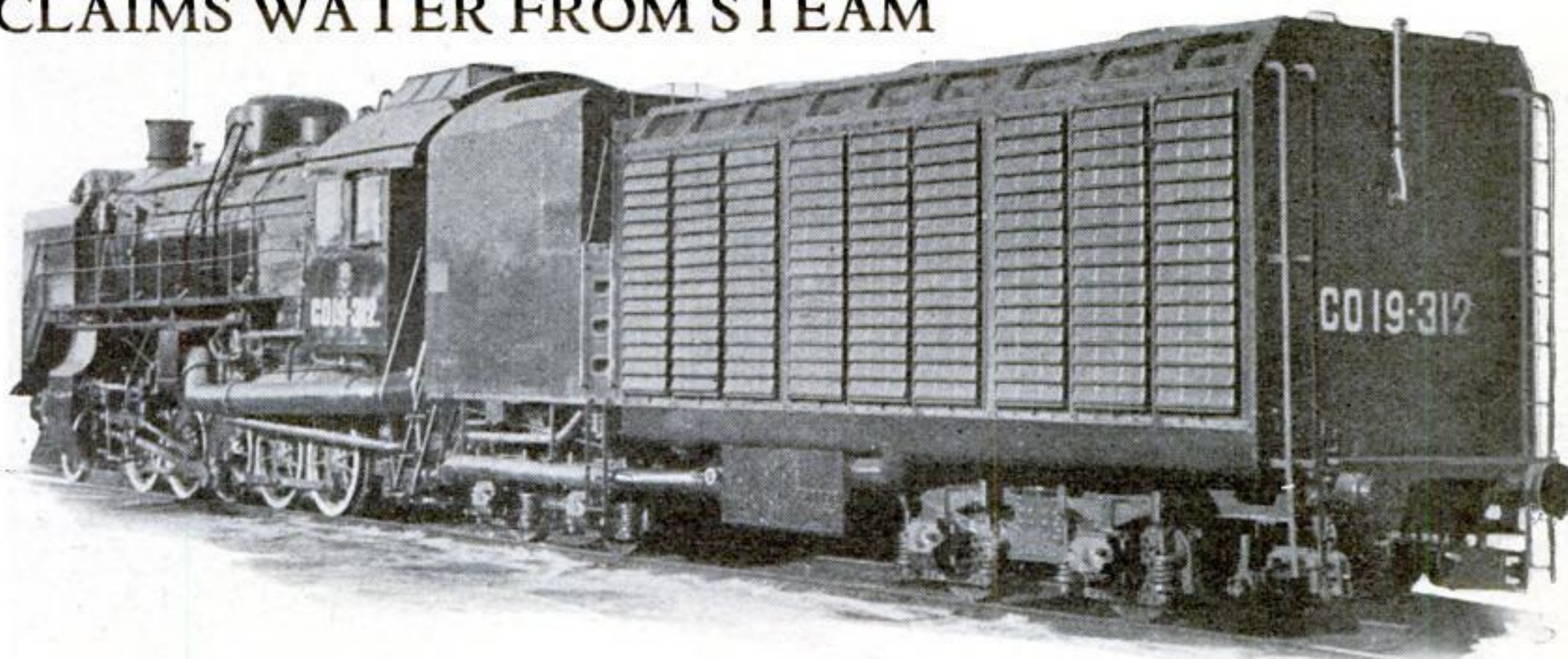
TO INSURE packing only perfect fruit, an X-ray machine developed in a California laboratory enables two operators to inspect 22,500 oranges, or a quarter of a carload, an hour. The oranges pass one by one before twin viewing screens of fluoroscopic material, where shadow pictures of their interior, cast by a single X-ray tube, show up juiceless cells and hollow spots. When an operator spots a defective orange, he punches a lever arranged so that it throws out the imperfect fruit. The oranges that meet his approval pass on through the conveyor to the shipping boxes seen at the right of the picture.

CARS GET ANTISKID DEVICE

A NEW antiskid device for automobiles sprinkles sand under the wheels of a car every time the brakes are applied. Fed from a boxlike hopper mounted beneath the floor boards, two nozzles squirt the sand directly under the rear tires, thus imitating the action of a locomotive's sand dome. In good weather, when the streets are not wet or icy, the sander can be quickly disconnected.

LOCOMOTIVE RECLAIMS WATER FROM STEAM

DESIGNED especially for long runs through arid regions of Central Asia, a "condensing locomotive" produced by Soviet technicians can travel long distances without taking on a fresh supply of water. Steam exhausted from its cylinders, instead of escaping to the air, is carried to a condensing apparatus housed in the shuttered tender seen in the photograph at the right. Here the vapor is cooled, and the water is reclaimed to be returned to the boiler and used over again.



He Captures Alligators for Zoos

Florida Woodsman Takes Big Reptiles Single-Handed In Thrilling Swamp Battles



"Mid" Eubanks setting out on an alligator hunt in a Florida swamp. He is carrying a .22 caliber rifle and the twelve-foot iron rod that he uses in "fishing" for the reptiles in their dens. At the right is shown the game he hunts



From behind a palmetto bush, the professional alligator hunter trains his rifle on an intended victim. Eubanks has killed as many as fifty 'gators in a single day

THE spine-tingling thrills of "catch-'em-alive" alligator hunting are not sport but part of the day's work for "Mid" Eubanks, of Daytona Beach, Fla. For forty years, he has been combing the swamps, sawgrass patches, and gum ponds of northern Florida for the ugly reptiles. During that time, he has killed and captured thousands.

In taking them alive, Eubanks uses a twelve-foot iron rod which has one end curved into a hook. Finding an alligator's den, he pokes the rod into it, prodding around until the enraged reptile within snaps at the steel and catches the hook in one of its jaws. Then, Eubanks tugs and twists until he has dragged the maddened alligator to the mouth of the den. Here, he renders the reptile harmless with ropes. Many of the alligators he has captured in this manner have been so huge that they could have snapped off a leg at a single bite.

On some hunting trips, Eubanks has killed as many as fifty alligators in one day, using only a .22 caliber rifle. He disposes of the hides to local dealers, sends the full-grown live reptiles to zoos, and captures baby 'gators for shipment north. Sometimes he finds as many as forty-five little alligators in one nest.

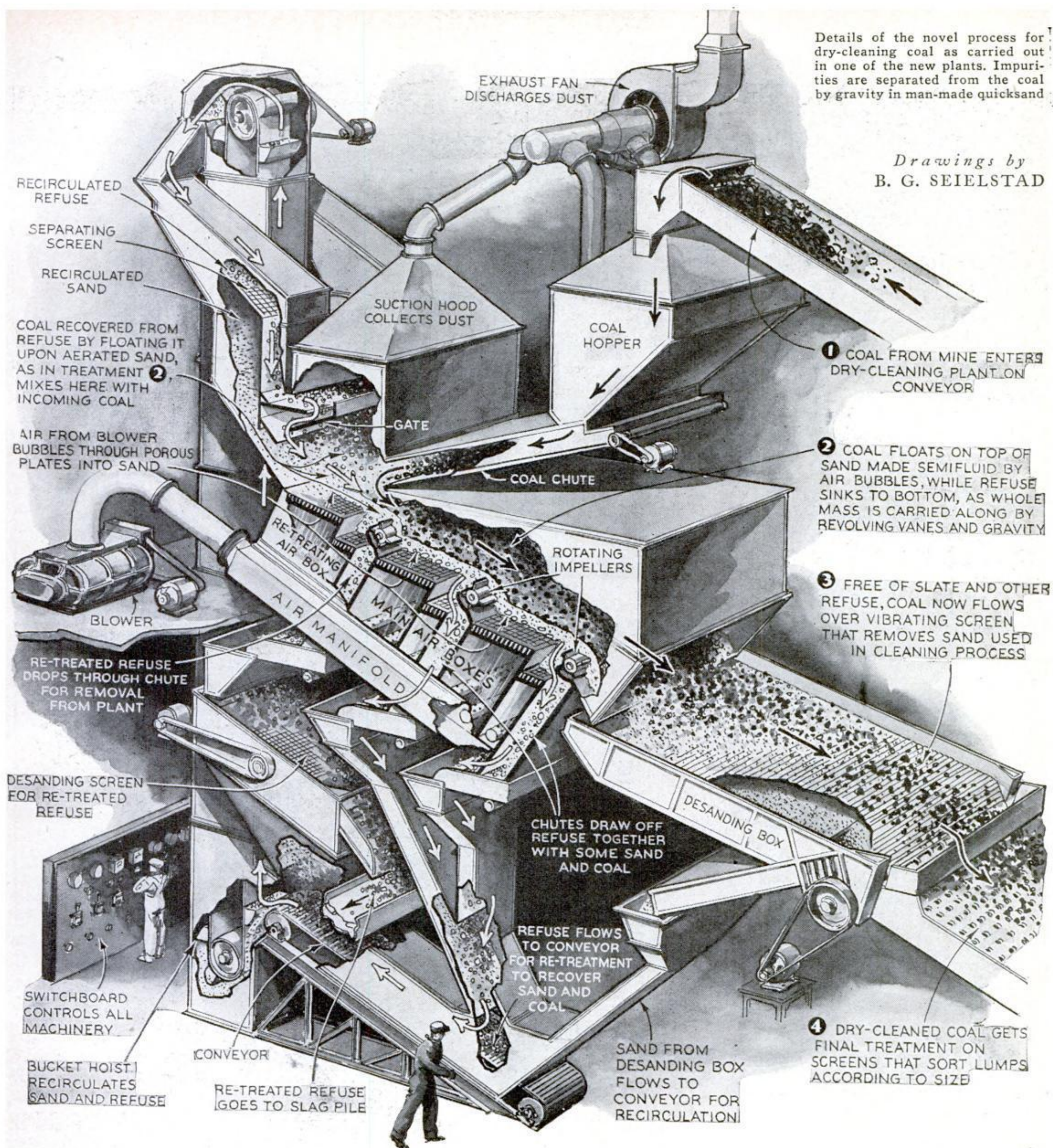


This is the hook with which live reptiles are dragged from their lairs to be "brought back alive" for sale to zoos. The alligator is hooked by the mouth like a fish

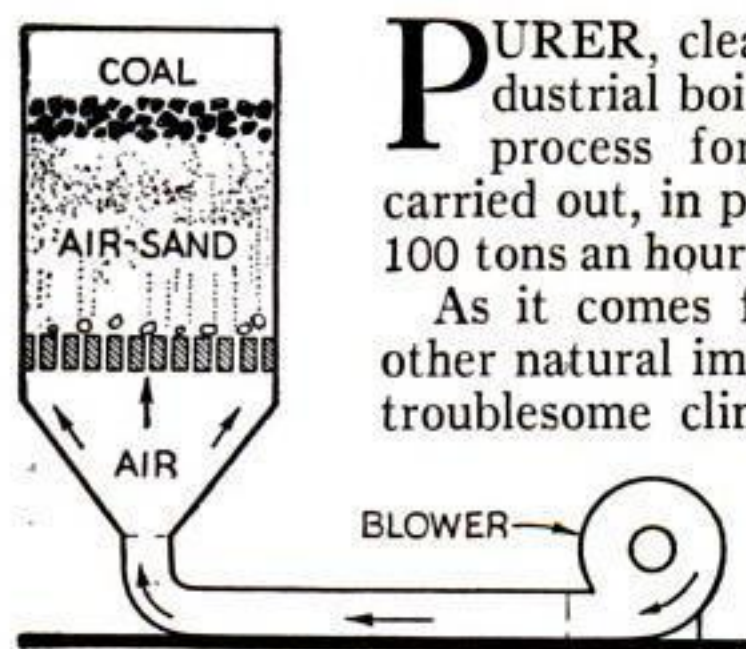
RAW MATERIAL FOR HANDBAGS

At the right, Eubanks is seen pouring salt on the inner surface of a hide. Alligators must be skinned in the shade to keep the barklike outer hide unspoiled





Sand Bath Dry-Cleans Coal



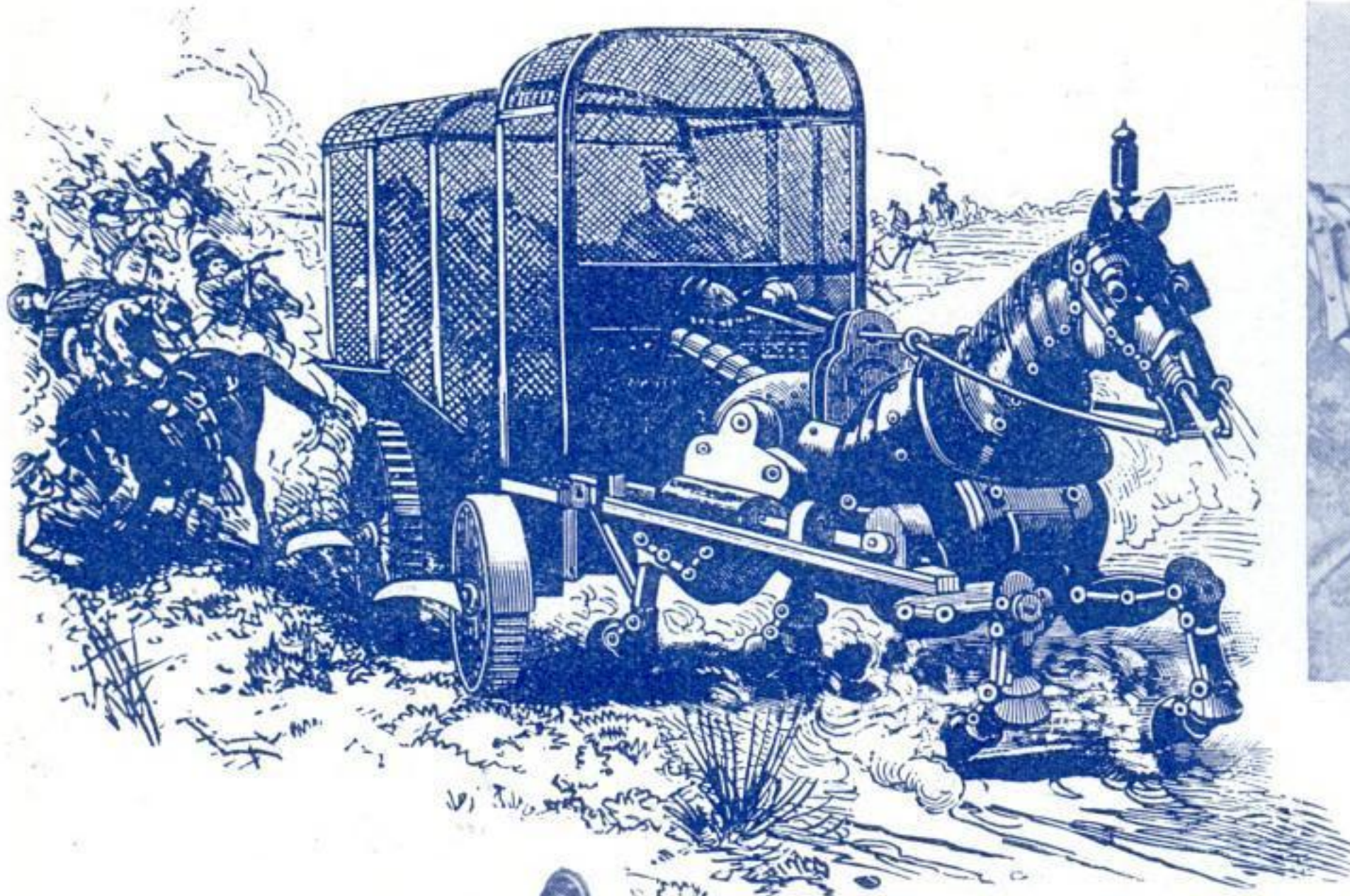
How pure coal "floats" on sand made semifluid by bubbles of air

PURER, cleaner fuel for household furnaces and industrial boilers is provided by a new "dry-cleaning" process for coal. How the ingenious scheme is carried out, in plants capable of handling from thirty to 100 tons an hour, is shown in the accompanying drawings.

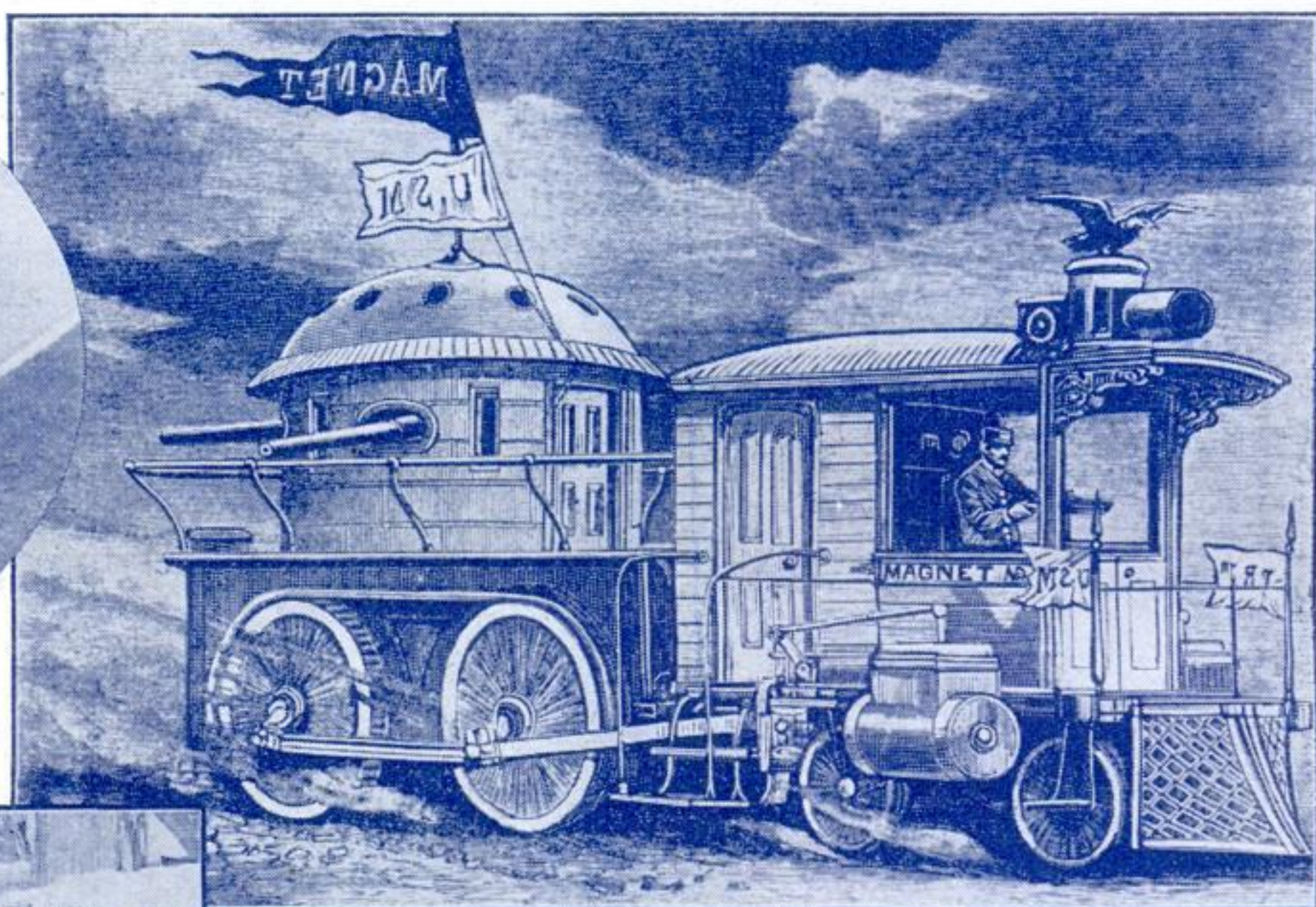
As it comes from the mine, coal contains slate and other natural impurities that impair its fuel value, cause troublesome clinkers, and produce excessive quantities of ash. In a common laboratory test of its quality, a ground-up sample is placed in carbon tetrachloride, a liquid a little more than half again as heavy as water. The coal floats, while the heavier impurities sink. The new proc-

ess applies the same principle on an industrial scale as a means of purifying freshly mined coal. Dry sand, made semifluid by blowing air bubbles upward through it, replaces a liquid as the separating medium.

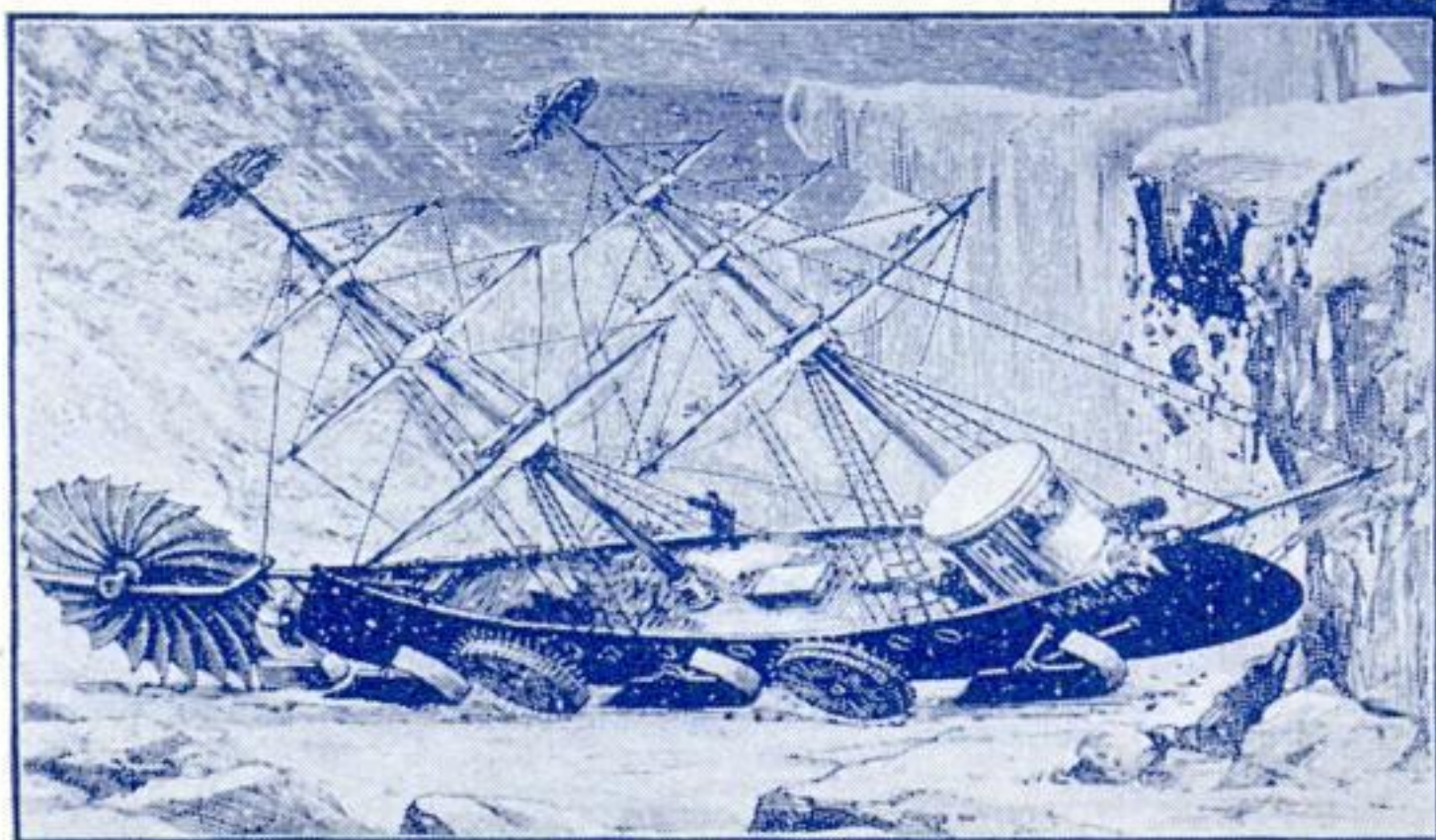
"Floating" on top of the artificial quicksand, the coal is freed of all foreign matter. Heavy, incombustible material sinks to the bottom and is discharged to a refuse conveyor. Dust set free by the scrubbing action of the shifting sand grains, as they churn like the water in a washing machine, is drawn off through a suction system. Since no water is employed in the cleaning process, the coal delivered to railway cars for shipment contains no moisture. Engineers declare that a ton of coal can be dry-cleaned for about eight cents.



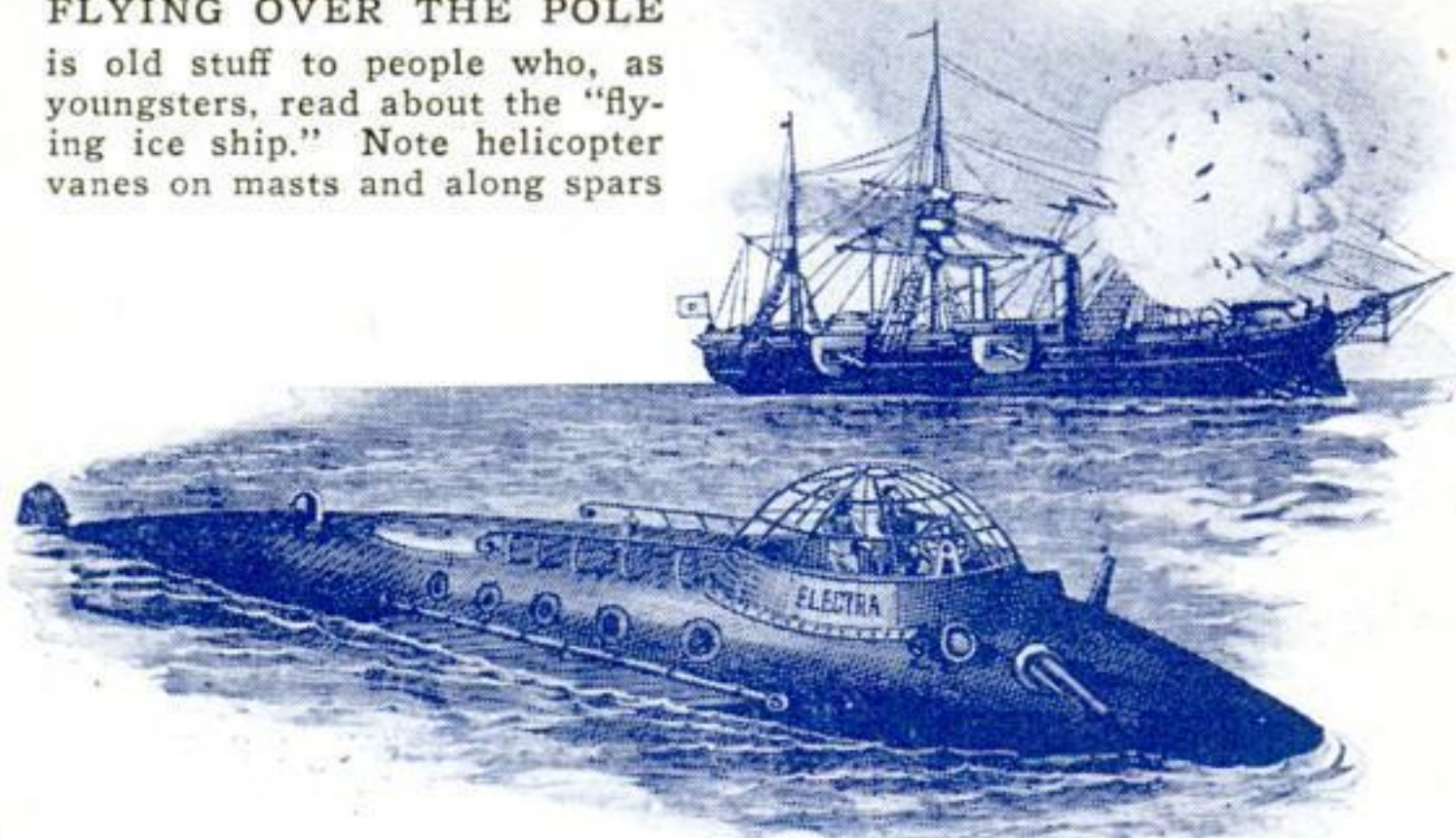
THE MECHANICAL HORSE that foiled mail robbers in the Frank Reade, Jr., dime novels of the nineties, has its modern counterpart in this recent Italian invention, which canters over the ground like a real steed. It is driven by a gasoline engine, while Reade's strange invention used steam



ARMORED CARS and war tanks were anticipated by the author of the Frank Reade stories in the marvelous "magnetic gun carriage." Its grotesque turret, pictured in this old illustration, gives it a striking resemblance to the twentieth-century armored truck shown at the left



FLYING OVER THE POLE is old stuff to people who, as youngsters, read about the "flying ice ship." Note helicopter vanes on masts and along spars



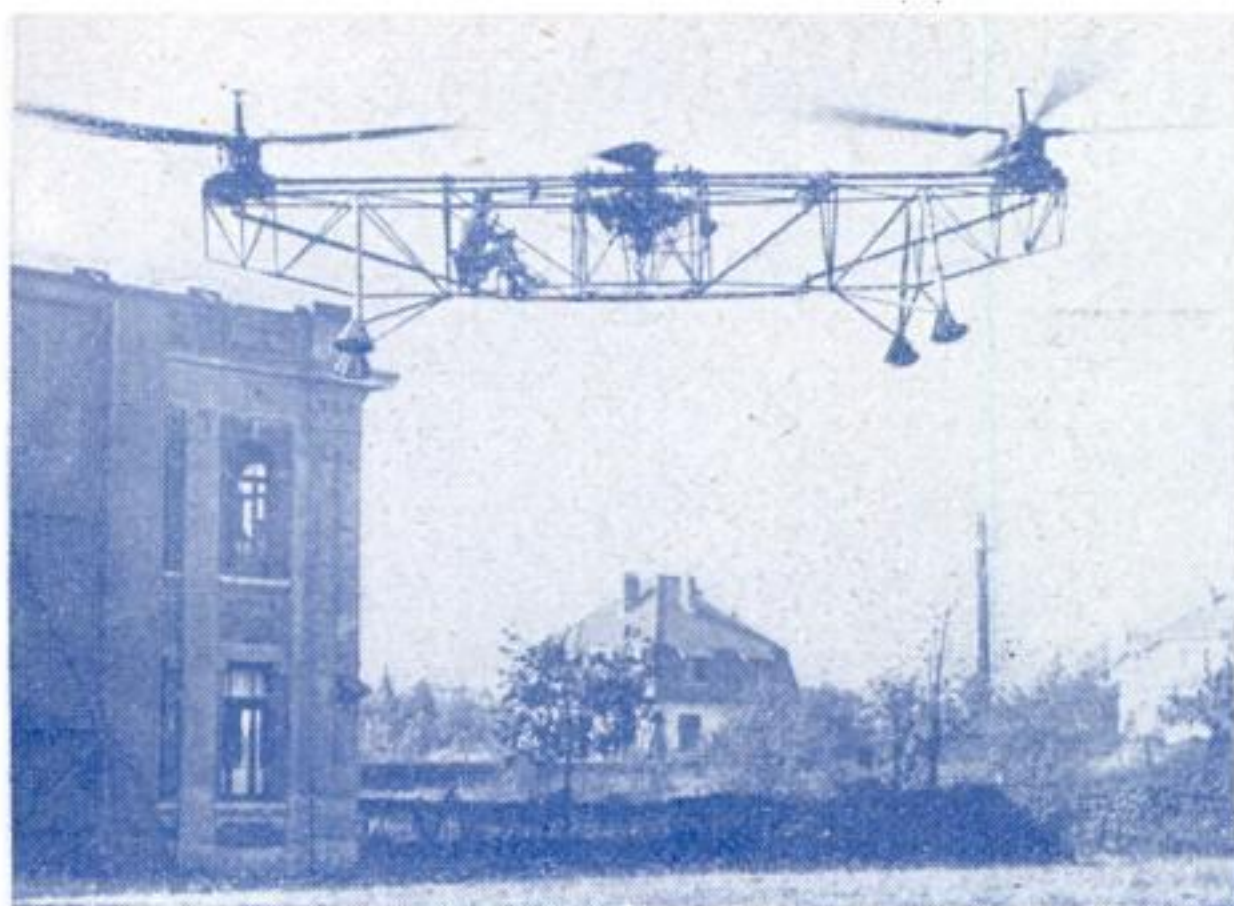
GUN-CARRYING SUBMARINES helped "Naname's" young hero in running down villains before the days of the Spanish-American War

Science Catches DIME-NOVEL INVENTIONS

WHILE Frank manipulated the reins, Barney and Pomp kept up a steady and rapid fire upon the foe. One after another the cowboys dropped from their saddles. In vain they lashed their horses to overtake the Steam Horse . . .

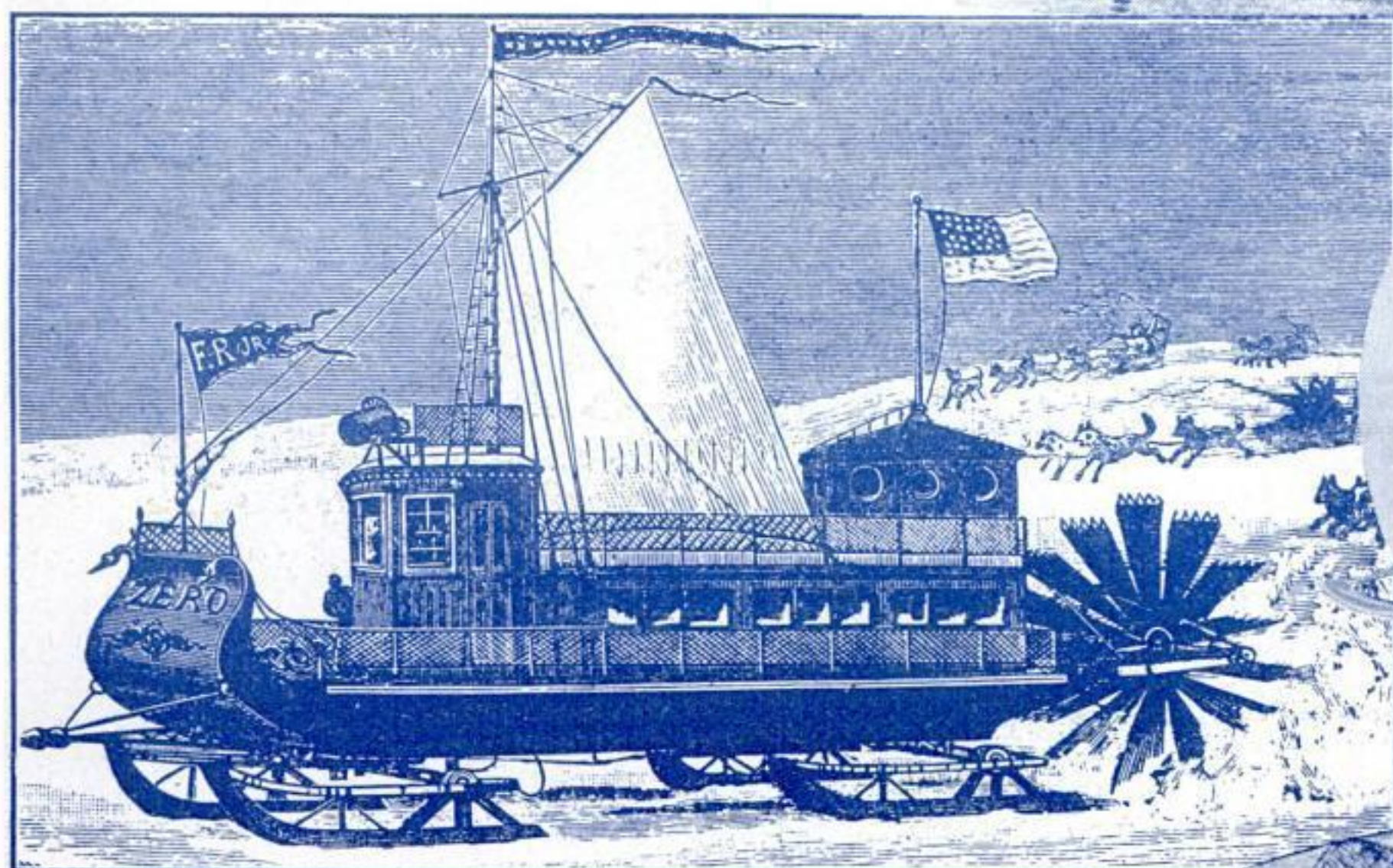
So wrote the author of "Frank Reade Jr. and His New Steam Horse Among the Cowboys"—one of the nickel-and-dime thrillers that parents frowned upon, and young boys slipped away to the attic to pore over, forty-odd years ago.

Today, many a grown-up man looking at the pictures reproduced on these pages will recall the steam-spouting horse and other equally fantastic inventions that lent color to the hair-raising adventures of Frank Reade and his son; the Irishman, Barney; and the Negro, Pomp, in the 200 or so weekly issues of the pulp-paper magazine that was known as the Frank Reade Library. They stamp the writer, Lu Senarens—then a young man in his 'teens—as a second Jules Verne. Writing under the pen name of "Naname" in an era when horses pulled street cars and magic lanterns were a popular form of entertainment, he lived to see science actually catch

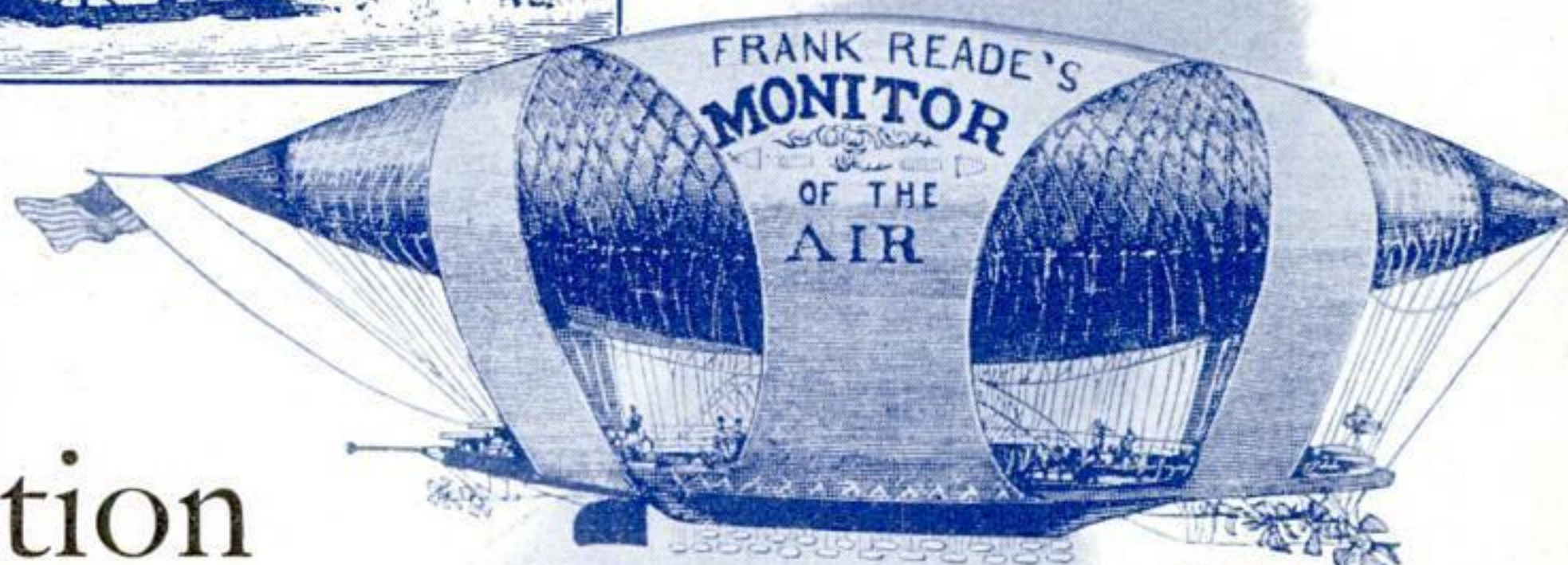


A PROTOTYPE OF THE HELICOPTER

Away back in 1893, readers of the Frank Reade thrillers were startled by the fantastic craft shown in the cover illustration reproduced at the right. The revolving, umbrella-shaped contrivances suggest the helicopter, a real specimen of which appears above



SNOWMOBILES, like the one seen in the oval at the right, can claim descent from the imaginary Zero. Powered by electricity, it kicked itself over the snow with a paddlelike stern wheel



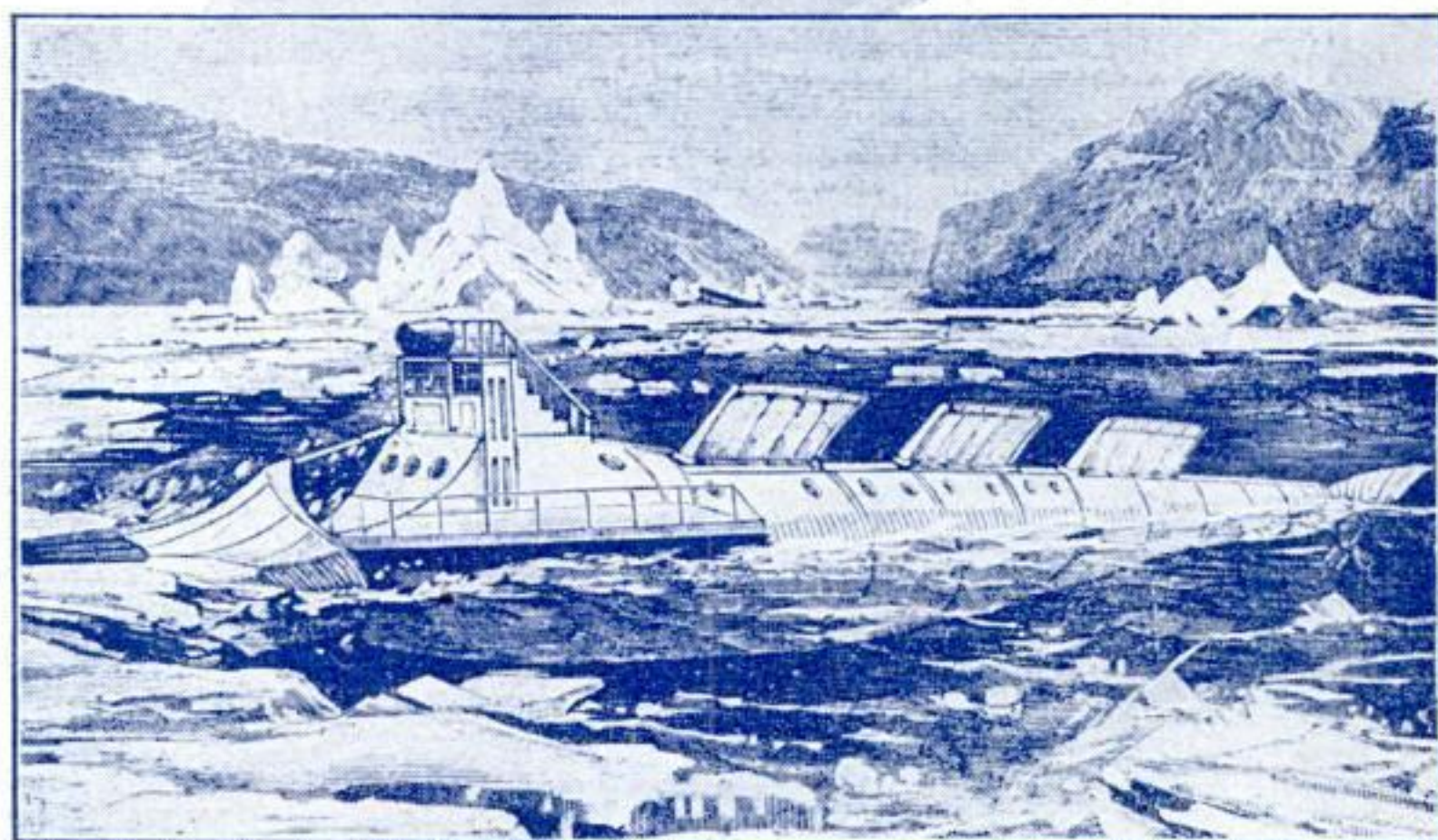
Nearly fifty years ago, Frank Reade fought air battles in his trusty dirigible, the *Monitor*

Up with Fiction THAT HAVE COME TRUE

up with some of his most imaginative flights of fancy.

Long before Sir Hubert Wilkins, British explorer, attempted to reach the North Pole in the submarine *Nautilus*, the hero of the Frank Reade novels set out to break a path through the ice floes in the electric submarine *Explorer*. The first Zeppelin had yet to make its maiden flight, and its value as an engine of war was undreamed of, when Senarens described a fighting airship in 1893. Armored cars used today to transport valuables employ gun-studded turrets that might have been copied almost directly from an illustration for one of the Frank Reade exploits. Even the helicopter was anticipated in some measure by Senarens' "Greyhound of the Air"—a flying machine equipped with unbrellalike propellers and flapping wings.

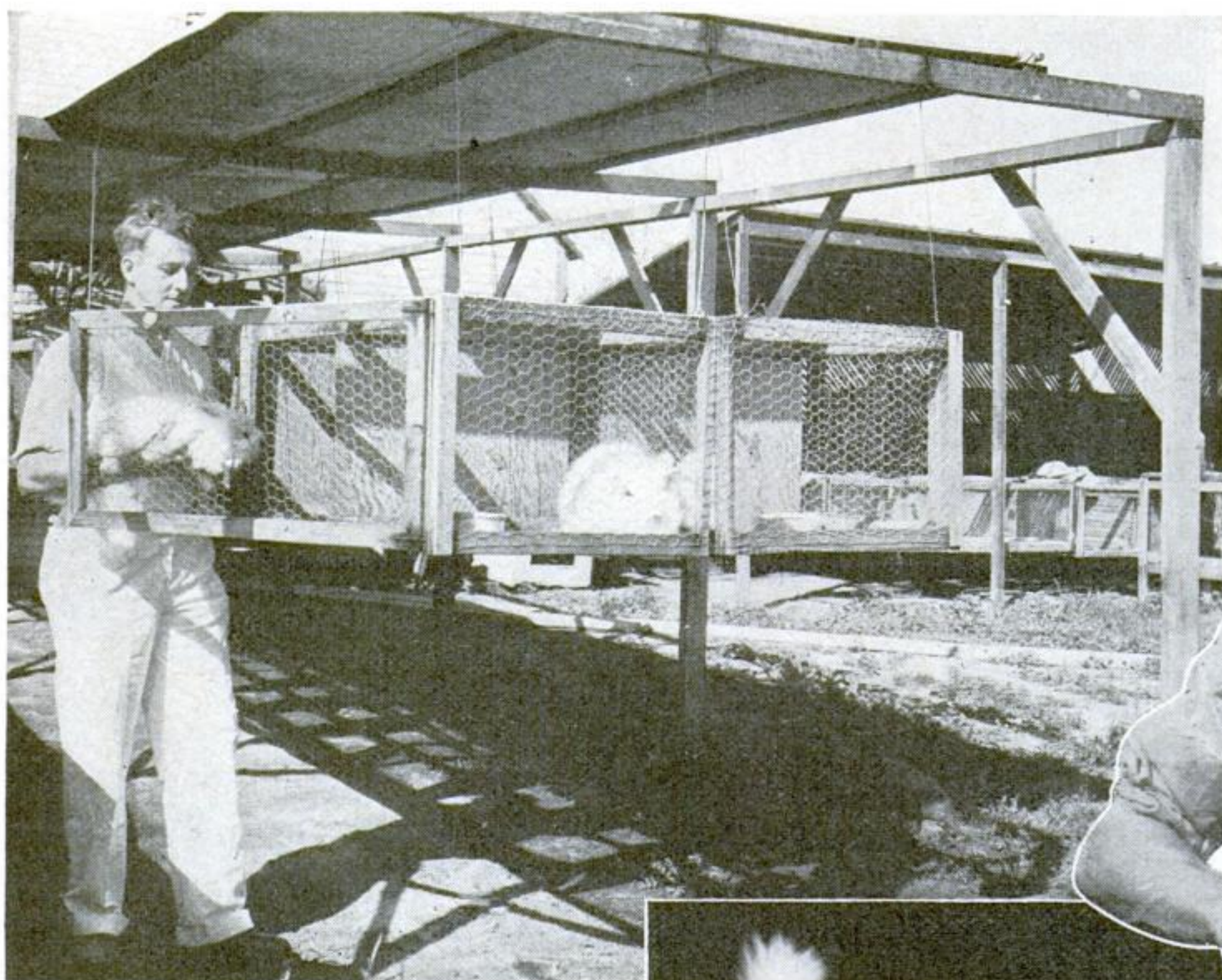
If parents of the nineties had known that such "cheap fiction" one day would be literally worth its weight in gold, they might have relaxed their disapproval. "Dime novels" of the period now are prized collectors' items. One hobbyist is reported to have turned down an offer of \$2,000 for his collection of 191 issues of the Frank Reade series.



UNDER THE ICE TO THE NORTH POLE. The idea of using a submarine in arctic exploration has a familiar ring to those who read, back in 1893, of the death-defying exploit of "Noname's" hero in the *Explorer*

Raise Your Own Wool on

By
JOHN E. LODGE



When space is available, single-tier hutches like these produce larger rabbits and better yields of wool. They are suspended from above

IN THE small quarters of your own back yard, you can grow mother's fur coat, sister's knitted suit, and brother's sweater, with a pair of warm socks left over for dad.

With two dozen Angora rabbits you can produce enough wool to supply the family with the finest knitted garments the market affords; and from the progeny of your first stock, you can secure fine pelts for neck pieces and coats which rival in beauty the most costly to be had anywhere.

Tan your own skins, spin and dye your own yarn. Methods are simple and inexpensive. It's the newest thing in fur farming, too. Three years ago, Angora rabbits were little known in the United States. Today there are 300 professional growers in southern California alone. Countless amateurs, particularly on the Pacific coast, are producing their own garments from these sons and daughters of Asia.

Let's suppose you are interested in Angoras and have decided to try your hand at growing these fine animals, both for pelts and wool. How much need you invest; how much room do you require; how may you turn the skins and wool to practical account?

At the outset, you should acquire your stock with considerable care, for many white rabbits are "woolly" without being Angoras. If you select animals that are well tufted on the ears, with short bodies, heads broad and well furnished, and feet and bodies generally well-wooled, you can't go wrong. As a further test, cut off some wool and throw it into the air. If it floats, rather than sinks heavily, you can



be assured that the rabbit is an Angora.

You need no more than four does and one male to start your back-yard wool farm. Thereafter, you may breed the does every ninety days. Keep only the four strongest from each litter, for they not only will grow more rapidly but will attain more total weight than a larger number. Thirty dollars will cover the initial costs, including both stock and breeding hutch, and you need a plot no larger than twenty feet square.

An ideal breeding hutch is forty-eight by thirty inches, and eighteen inches high, with one-half to five-eighths-inch hardware cloth (coarse wire screen) for the floor and one-inch mesh chicken wire for the sides, provided the hutch is sheltered from the weather. If it is outdoors, put on a roof with six to eight-inch slopes, with the front edge of the roof extending out eighteen inches. Cover the roof with tar paper. Construct back and sides from half-inch boards. Face the hutch south for coolness in summer and for warmth in winter. Suggestions for the



In clipping, part the wool along the back and work forward and down, using blunt-nose, sharp scissors. Your clipped rabbit should look like the one shown at the left, with hair on face, ears, feet, and tail untouched

design of hutches, feeders, nest boxes, and runways can be obtained from the breeders' associations and from state or Federal agricultural agencies.

Since you are creating wool, not flesh, the Angora's diet will vary slightly from that given other rabbits. Give each two feedings a day, alfalfa in the morning, red



Rabbits can be marked for identification by tattooing the ears with India ink. Here, this is being done with a pencil that has five sharp needles for puncturing the skin

a Back-Yard Rabbit Ranch

oats or barley in the evening, for a total of two and a half ounces. It is better to use cut, dry alfalfa, of good quality only, to avoid scours or bloat.

If you do not feed too heavily, the rabbit will clean up his meal in twenty minutes. Should he leave any of his food, the chances are that he is suffering from wool block in the intestines. To remove the block, give the rabbit one teaspoonful of mineral oil. If he is subject to block, apply this remedy once a week. Should he not respond, and appear feverish, give two tablespoons of epsom salts and place him on the ground where he can exercise, giving a vegetable diet for three or four days. This treatment usually will bring him around.

When ready to clip, place the Angora on a stand or stool with a top just large enough to permit the animal to sit without turning around. Brush thoroughly, using a stiff bristle brush, taking care to clean out all foreign matter. Part the wool down the center of the back. With an ordinary pair of well-sharpened, blunt-pointed scissors, start from the rear and work forward, taking sections down and around the animal. Insert the lower jaw of the scissors near the end of the part and clip down this line, holding the upper part about half an inch from the animal's hide.

As you proceed, take care to separate the various grades of wool by length. This is particularly important, since the longer wool is worth about ten times as much as that in which long and short hairs are mixed.

Continue clipping until you have finished one side, turn the animal over and clip the opposite side, then the rump. Be

very careful in clipping near the tail or you may cause an injury.

If you have been clipping a breeding doe, you have now finished your task. Bucks and young stock, however, may also be clipped on the belly and breast. To accomplish this, place the animal's ears down over the shoulder, pick up gently both the ears and the loose shoulder skin, raise the animal, and rest its rump on the stool. Now proceed to clip, taking the wool first from the breast and then from the belly. If the Angora becomes too active, hold it up by placing the skin of the forehead between your thumb and forefinger. After a little experience, you will find you can clip an Angora in six or seven minutes.

Since the fine wool may suffer from too much handling, place each grade by hand in a separate receptacle. If it is to be stored for any length of time, it is better to use some good moth repellent. Do not press the wool down in the sacks or cans, but lay it in carefully. Tight packing frequently causes webbing, for the wool has a high felting capacity.

The young may be clipped when eight to ten weeks old, and about every nine weeks thereafter, depending on the length



On the scales are twelve ounces of wool, the average year's yield from a single animal. Some produce nearly twice as much

of wool you desire. Wool from two to two and a half inches long is worth about four dollars a pound, while that exceeding three inches will bring six dollars. Since an Angora produces, on an average, twelve ounces each year, and some up to twenty-three ounces, it is important to take the longest wool possible and preserve it in packing and shipping.

Here are a few tips which will help you avoid mixing grades: Never clip ear tufts or furnishings on the face; never clip the wool underneath the feet; never clip over a second time to make your job look better, for this short wool is worthless. With a little experience, you will soon be doing a first-rate job of clipping.

Hand-spinning this fine wool is quite practical as a hobby, and from it you can produce many articles of value, from scarfs to sweaters. The wool also takes dyes nicely, and will retain color from better grades of dye without fading. Use a spinning wheel of the Swedish type, spinning the wool as it is clipped from the rabbit in exactly the same way as sheep's wool is spun. It is not necessary in hand-spinning to card the wool, as is required in high-speed commercial production of Angora wool yarn.

It is advisable to use raw wool from two to three inches in length. Long wool is easier to work and less apt to shed after spinning. It should be spun in a single strand, then double-twisted. Because it is lighter and warmer than other yarns, this double twist will be found quite heavy enough for sweaters, baby garments, and hosiery; for any garments, in *(Continued on page 128)*

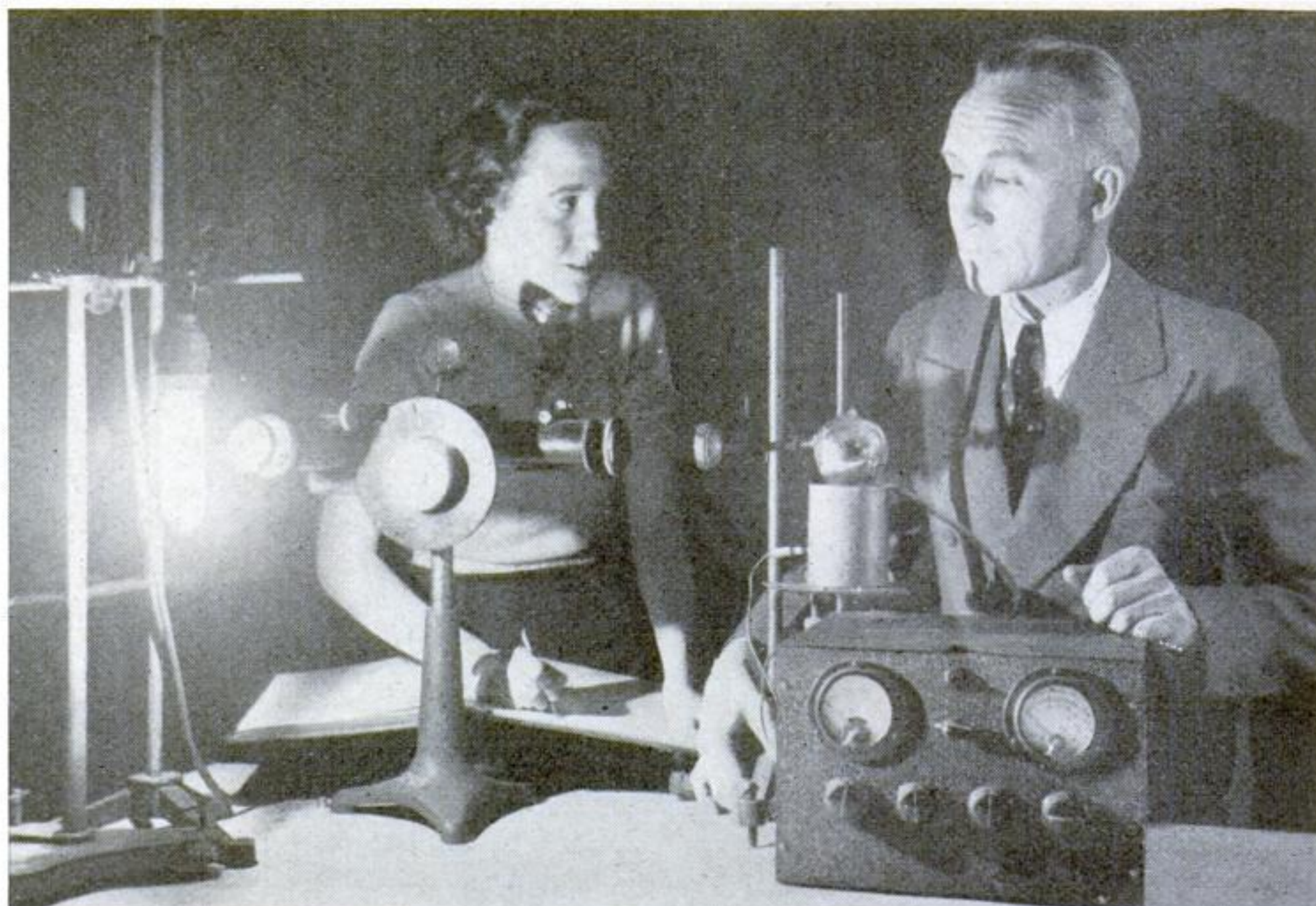


The woman in the picture above is wearing knit garments made from rabbit wool, and a fur piece from pelts. Right, spinning wool on a Swedish-type wheel to make yarn

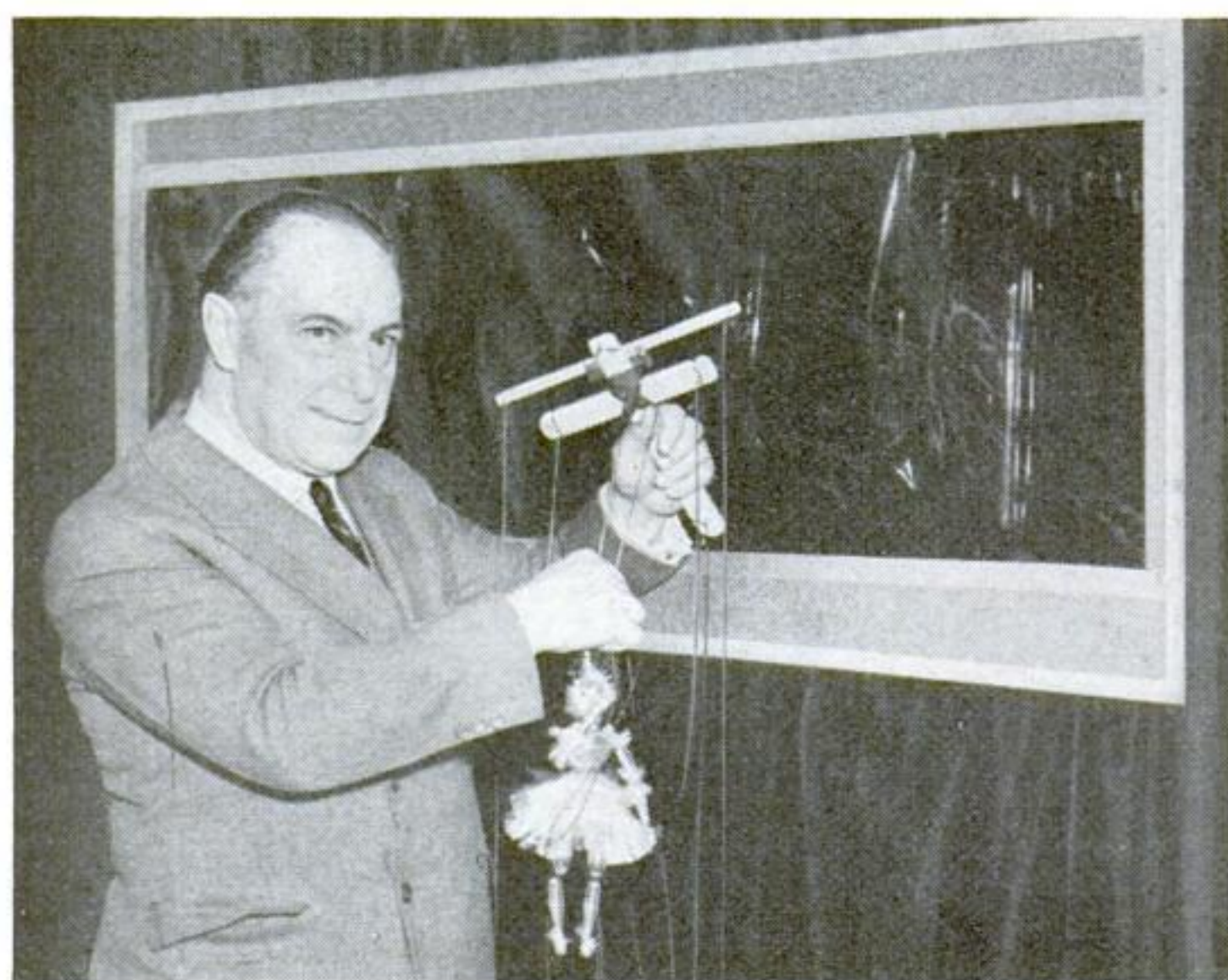


Meter Gauges Sun's Rays

NICKNAMED a "sunburnometer," a recording instrument developed by Prof. Walter S. Huxford and Prof. Robert Cashman of Northwestern University, measures the intensity of ultra-violet rays which cause sunburn. The device utilizes a new type of photo-electric cell which responds only to ultra-violet radiations, while special filters block the passage of longer and shorter light wave lengths. Although the apparatus was designed primarily to determine the value of ultra-violet radiations given off by various therapeutic lamps used in hospitals and medical clinics, it could be used by sun bathers at beaches and other vacation resorts to test the burning qualities of the sun. In the photograph at the right, rays emitted by an ultra-violet lamp are directed through a special system of filters onto the recording unit being adjusted by Prof. Huxford.



This instrument measures the intensity of the ultra-violet radiations in sunlight or from lamps



POLARIZED LIGHT CLOTHES PUPPETS

ALTHOUGH dressed in colorless cellulose material, puppets appear to be garbed in brilliantly tinted costumes on a novel marionette stage devised by Tony Sarg, famous New York artist. White light shining on the marionettes is changed into a myriad of lustrous hues by special polarizing screens (see page 72).



SKATE WHEELS ARE SELF-STEERING

ROLLER SKATES of new design have front wheels which automatically steer themselves in the direction of the skater's movement as he leans to one side. Front and rear wheel trucks are connected to the skate chassis by coil springs which "give" as the skater makes a turn. Since the wheels stay level at all times, skidding is said to be eliminated.

Spring mountings of wheel trucks allow the skater to lean to one side while all wheels remain on the ground. At right, how the front wheels steer

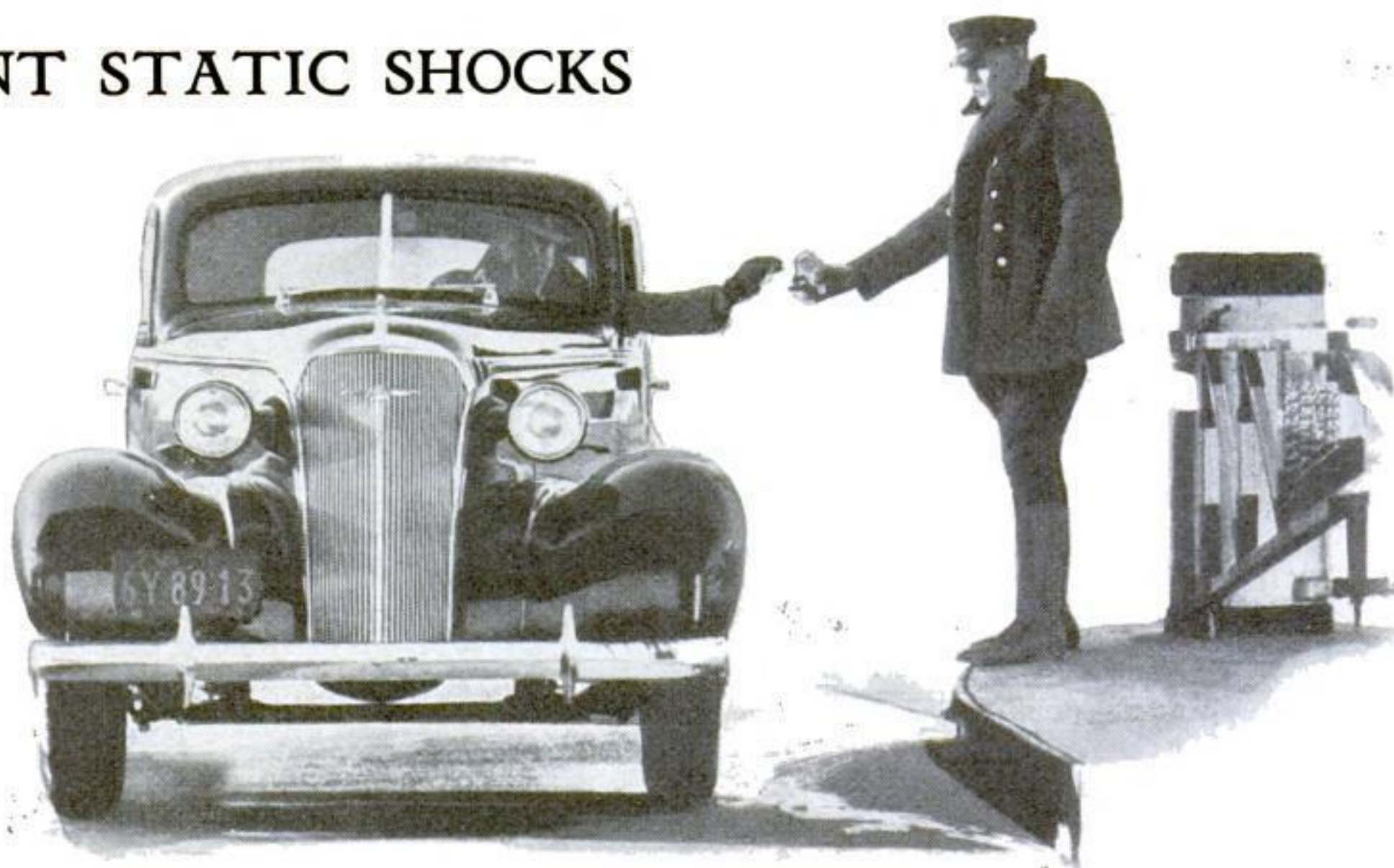


WATER JETS PREVENT STATIC SHOCKS

JETS of water, playing on the wheels of automobiles that pass the toll booths on the new Triborough Bridge in New York City, ground static electricity to prevent shocks to drivers and toll collectors. Before the pipes were installed, annoying shocks were often felt as coins changed hands. Electric charges now pass from the auto wheels through the water to the ground before the motorist places a coin in the collecting machine, as shown in the photograph at the right.

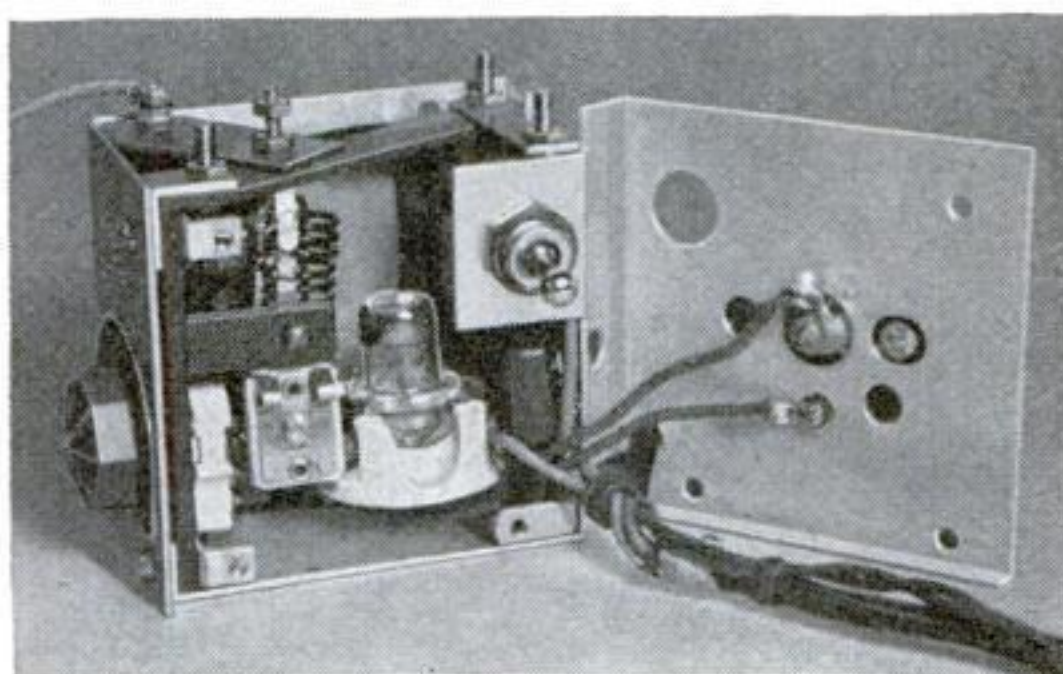
USE RADIO STETHOSCOPE

THROUGH a radio stethoscope, Russian medical men, on the ground, can listen to the heartbeats of an aviator miles above the earth, to determine the effect of altitude and various flying conditions.



TINY RADIO WEIGHS FOURTEEN OUNCES

BELEIVED to be the smallest two-way radio of its type in existence, a combined receiving and transmitting set developed by a New York inventor is housed in a shielded aluminum case only three inches high, three inches wide, and one and a half inches deep. The tiny transceiver operates on ultra-short wave lengths of from three and a half to four meters, and has a transmitting output of approximately one tenth of a watt. Powered by pocket batteries that weigh only one pound, the set makes it possible to carry on a two-way telephone conversation over a distance of about a half mile. Complete with two fourteen-inch, rod-type antennas, the radio itself weighs only fourteen ounces. Flipping a small switch changes the set from a receiver to a transmitter, while the single tuning dial controls both transmitting and receiving frequen-

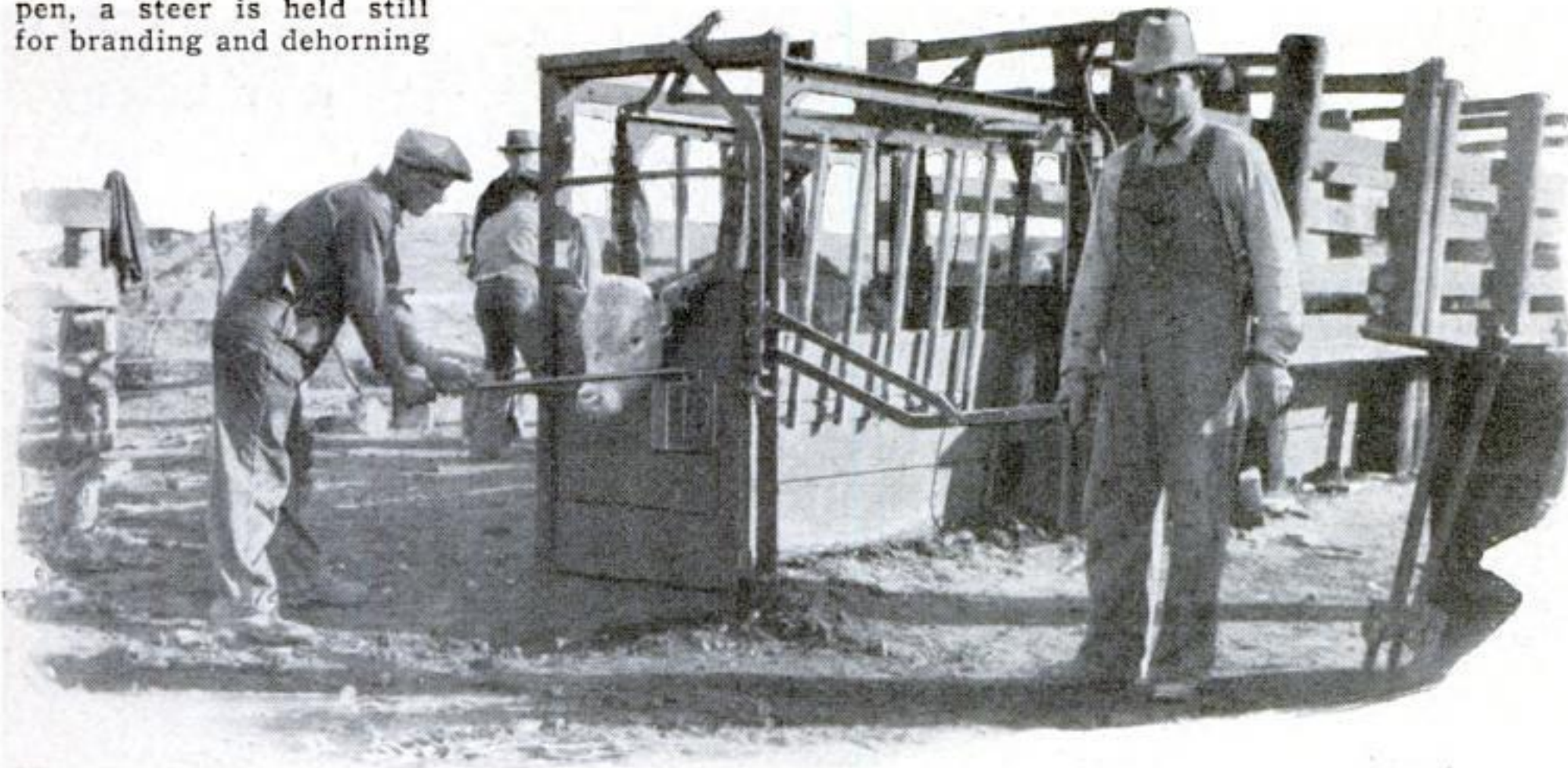


Midget radio transmitting and receiving set opened to show its parts. At right, the unit in use with rod antenna attached

cies. The microphone is mounted on the side of the unit, and cords give a connection to the earphones and batteries. Slight modifications in the set, and increased power, raise its range to about five miles.



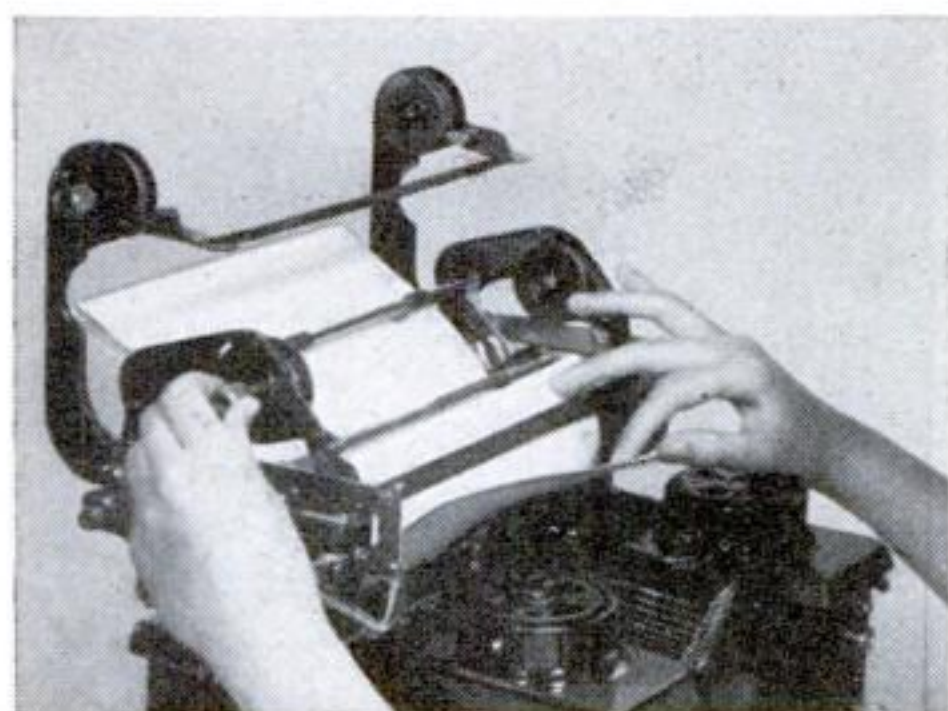
Clamped in this viselike pen, a steer is held still for branding and dehorning



HOLDING PEN SPEEDS CATTLE BRANDING

A NOVEL holding machine on an Arizona ranch replaces conventional lassoing and tying of cattle for branding. When a steer is driven from a chute into the odd pen shown in the illustration, cowboys push a lever that forces the walls inward against

the sides of the animal, clamping it tightly in place. With the steer unable to kick or thrash about, ranch hands claim that it can be branded, sprayed, inoculated, and dehorned in less time than was formerly required for the branding operation alone.

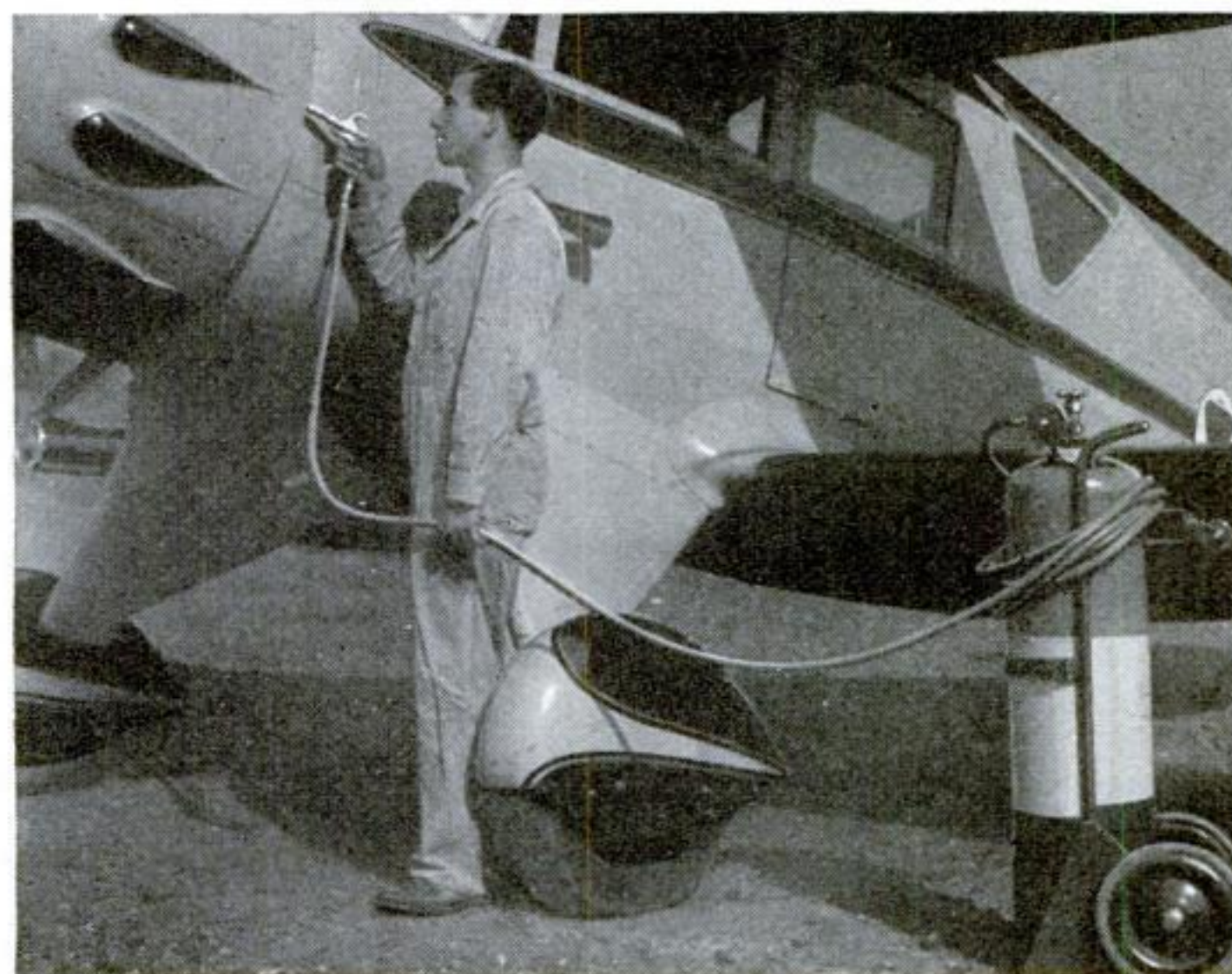


MULTIPLE RIBBONS MAKE TYPEWRITER DUPLICATES

WITH a new typewriter attachment, as many as four copies of a typed letter can be made at one time without the use of carbon paper. The device feeds a set of inked ribbons between the individual sheets of paper so that each copy is virtually an original. Duplicates made by the device are said to be free from smudges.

GAS PRIMES MOTORS FOR COLD STARTS

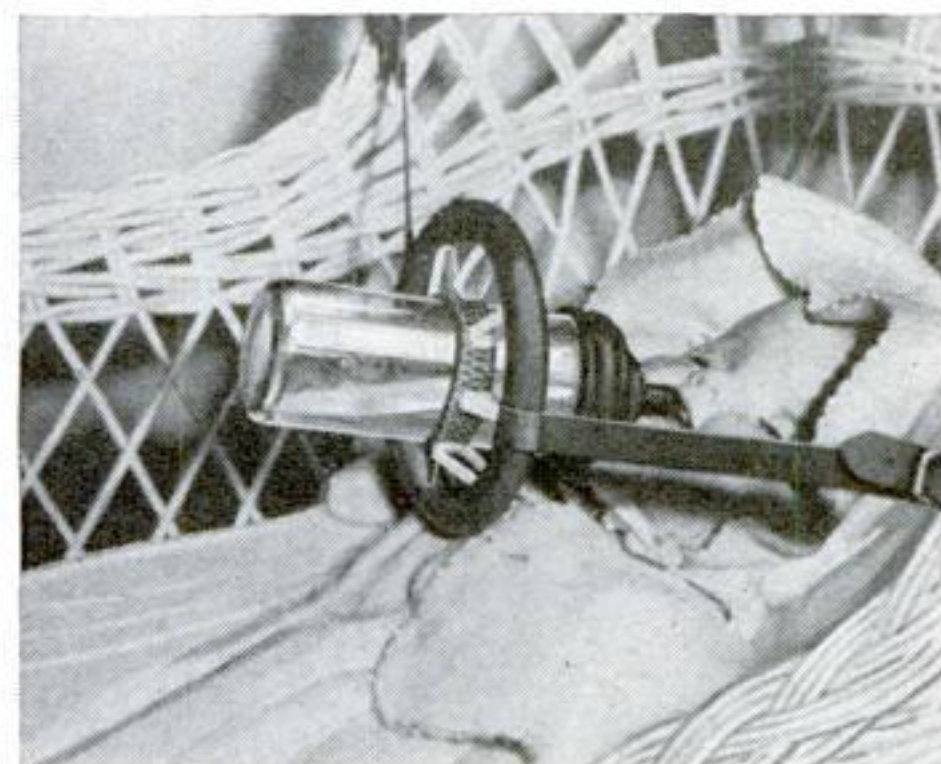
AUTOMOBILE and airplane motors are easily started in zero weather with a new engine accessory just marketed. Attached to an engine intake manifold, the device primes the cylinders with propane gas, a highly combustible petroleum product. The inflow of the gas is controlled by a trigger, which is pressed for a few moments before the operator turns on the ignition and starter. The photograph shows a large portable unit designed for airports and large garages.



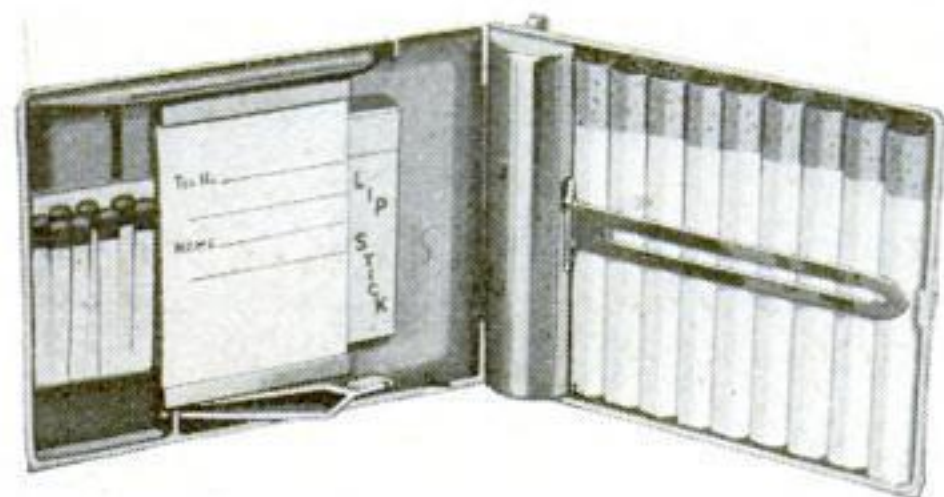
A mechanic priming a plane's motor with propane gas from a portable unit

BABY'S TEETHING RING HOLDS NURSING BOTTLE

TEETHING RING and bottle holder are combined in a new nursery aid to mothers. Suspended from a baby's crib or cradle by straps, the rubber ring holds the infant's bottle at the correct feeding angle, thus eliminating the necessity for parental attention at meal times. When not in use as a bottle holder, the device presents a suitable surface for cutting teeth.



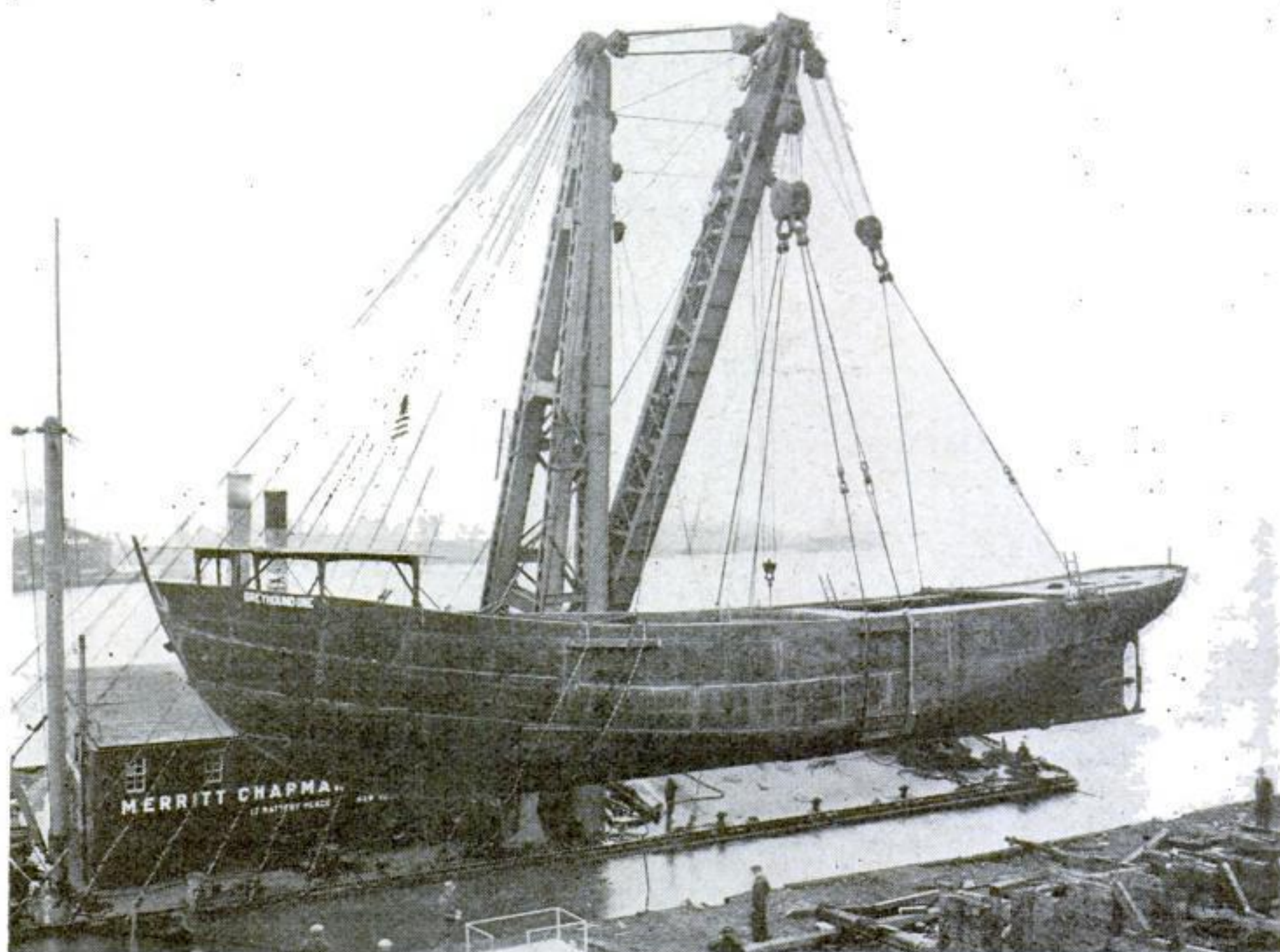
Teething ring in use for holding nursing bottle



POCKET MAKE-UP KIT HAS FLASH LIGHT

ALTHOUGH no larger than a conventional cigarette case, a new make-up kit for women contains ten separate articles. Compactly stored in the convenient unit are a mirror, rouge, powder, lipstick, tweezers, cigarettes, matches, pencil, paper, and small flash light. The light unit may be used to illuminate the face, or it can serve as an independent flash light.

FLOATING DERRICK LAUNCHES VESSEL



A derrick replaced the usual greased shipways in the launching of this 130-foot fishing trawler

INSTEAD of sliding down greased ways, a large fishing trawler recently built in a Brooklyn, N. Y., shipyard was launched by one of the world's largest floating derricks. Although the boat weighed more than 150 tons and measured nearly 130 feet from stem to stern, the huge crane hoisted the craft from its construction

cradle and deposited it in the water with hardly a splash. First of a series of new fishing boats to be constructed for a New England fishing company, the trawler is powered by Diesel motors and contains a specially insulated, nickel-lined fish hold to keep the fish as fresh as possible while the boat is bringing its catch into port.

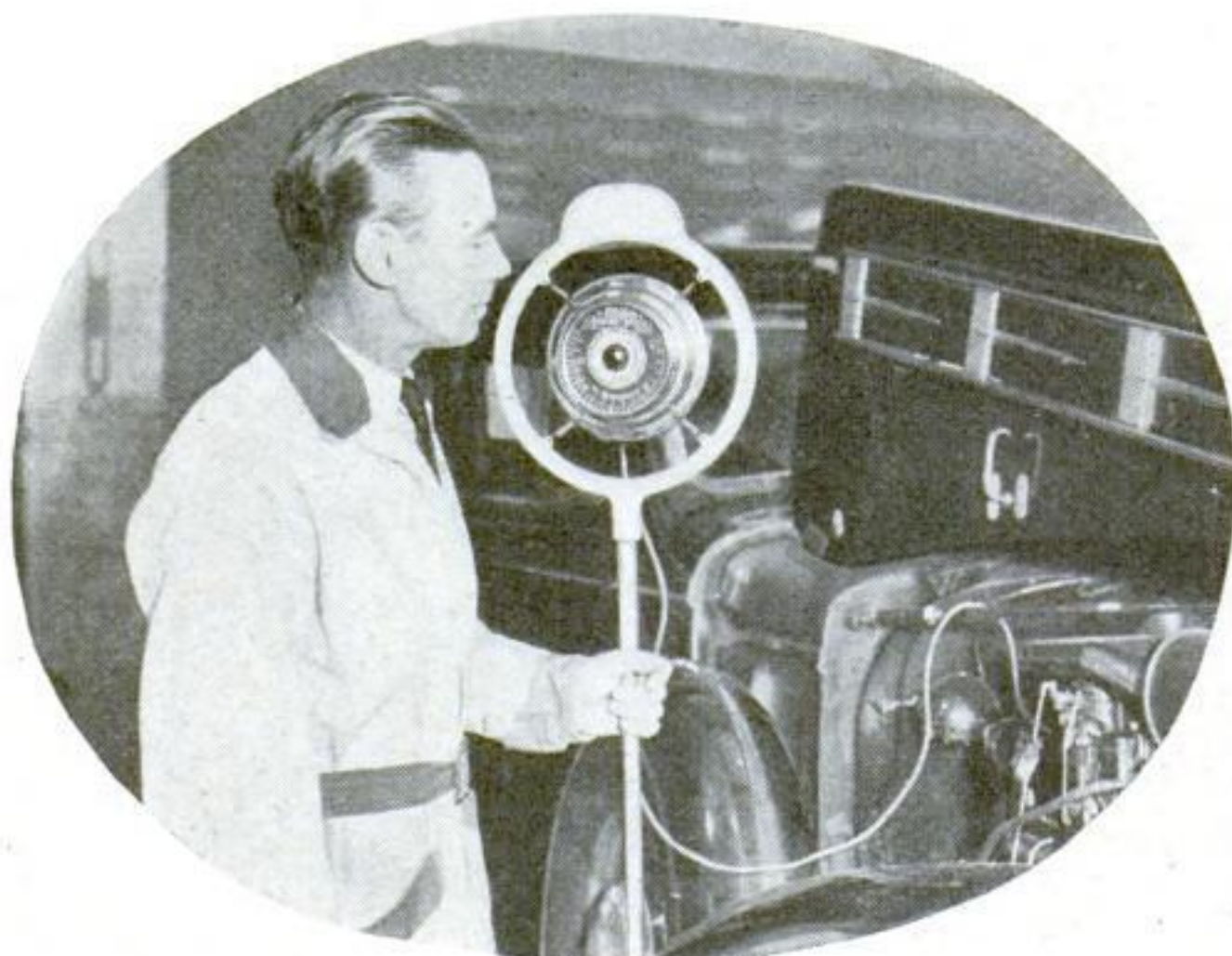


Prof. R. H. Wheeler "writing a book" with pages four feet long and eighteen inches in width

BOOK WRITTEN BY HAND WEIGHS 110 POUNDS

FOR use as a research and reference guide, Prof. R. H. Wheeler, psychologist of the University of Kansas, is preparing the mammoth volume shown in the photograph at the left. Many hours of arduous research, writing, editing, and correcting were involved in the composition of the work, which was written by hand on pages four feet long and eighteen inches wide. The completed work, which is said to weigh 110 pounds, deals with the interrelation of data in various fields.

ODD INSTRUMENT TESTS CAR'S ENGINE



Connected to an ailing motor, this device locates the trouble

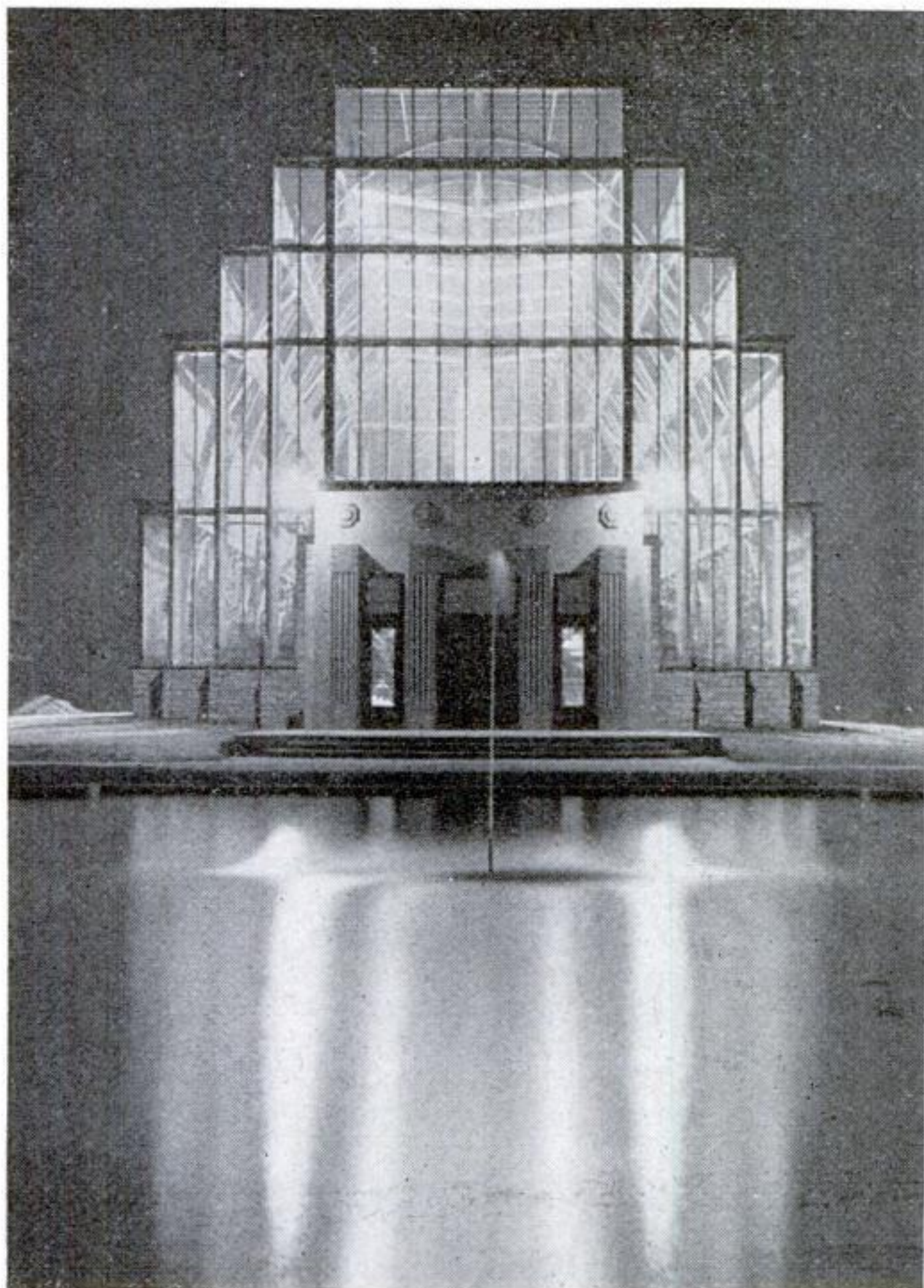
LOOKING like a radio microphone, a new instrument detects the location of irregularities that cause faulty operation of automobile engines. When the apparatus is connected to the motor, variations in the vacuum in the intake manifold are shown on a graduated dial. A second dial is set at a point indicating normal motor operation; by comparing the two dial readings, the exact nature of the engine trouble can be determined.



Automatic starter attached to a radiator hose

STARTS UP COLD MOTOR TO WARM IT

ATTACHED to the radiator hose connection, a thermostatic device just marketed automatically starts an automobile motor in cold weather to keep it warm and to prevent the water from freezing. When water temperature drops to a low point, the unit starts the motor; when warmed, the engine is shut off. Designed for cars parked outdoors or in unheated garages, the apparatus works only when both ignition and car doors are locked.



NOVEL GREENHOUSE IS MODERNISTIC

RESEMBLING a giant diamond set on a polished table, a modernistic greenhouse has just been opened in Forest Park, St. Louis, Mo. Supported on curved metal arches like those used in dirigible hangars, the walls of the conservatory are made of large rectangular sections of glass held in place by vertical metal columns. At the time of the opening, spotlights in the interior bathed the structure in a brilliant glow, which was mirrored in the waters of an adjacent pond. Architects state that the modernistic design of the glass conservatory is unique.

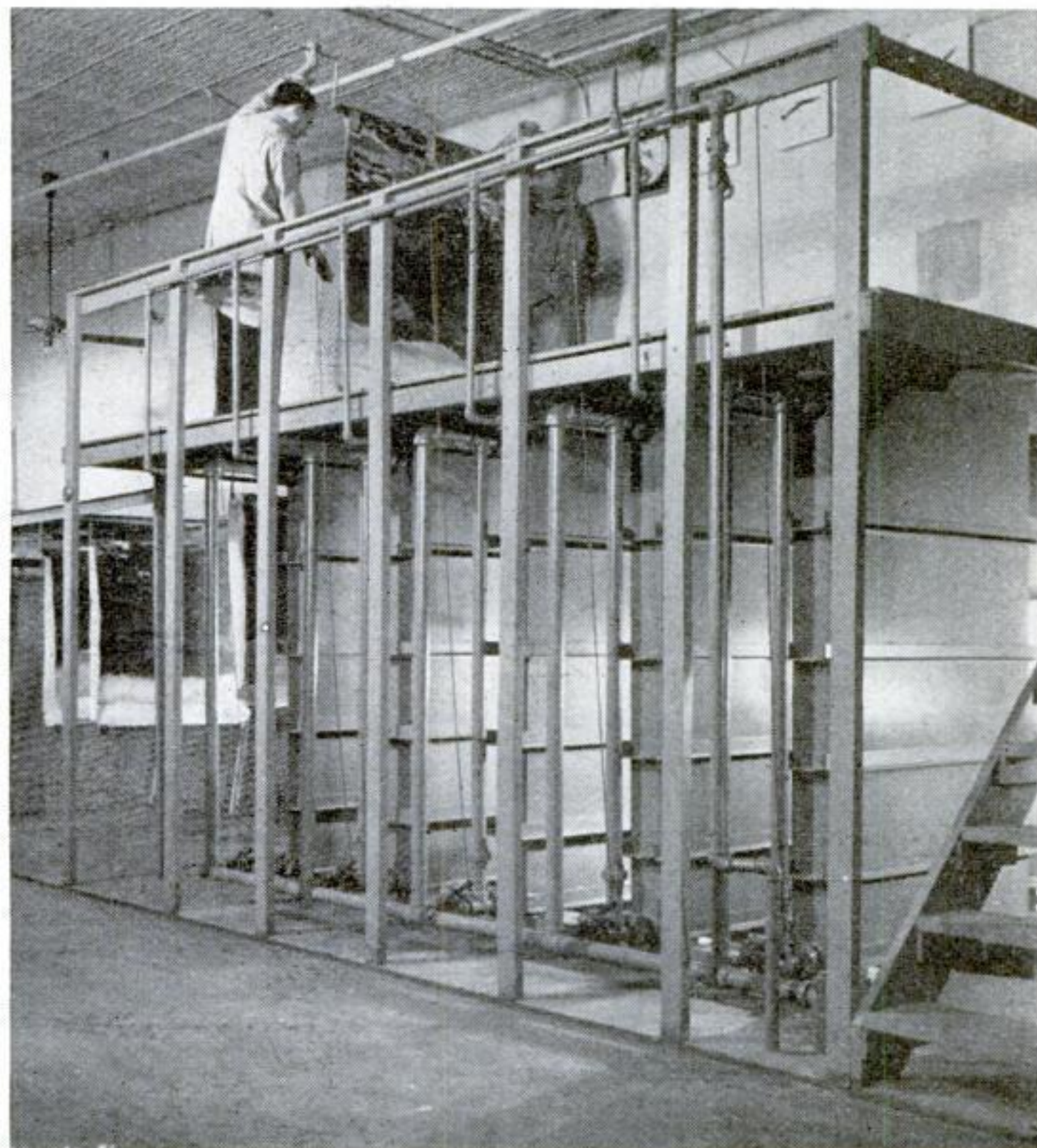


TESTS CAR HEADLIGHTS

AUTOMOBILE headlights can be tested in either daylight or darkness with a new portable electrical device just introduced. Held against the headlight lens, the ball-shaped apparatus utilizes a photo-electric cell to register headlight intensity on a small meter. A second meter records the voltage of the car battery.

HUGE TANKS WASH PRINTS FOR MURALS

GIANT photographic prints used in making mural decorations are washed in mammoth tanks just installed in a Chicago, Ill., photographic plant. By looping the print, each tank can accommodate a positive forty-two inches wide and twenty-five feet long. Filtered water flows through the 114-gallon containers, which are made of stainless steel that is said to resist chemical action and prevent chemical contamination of the water during the process of washing the photographic prints.



Photographic prints twenty-five feet long are washed in these big tanks

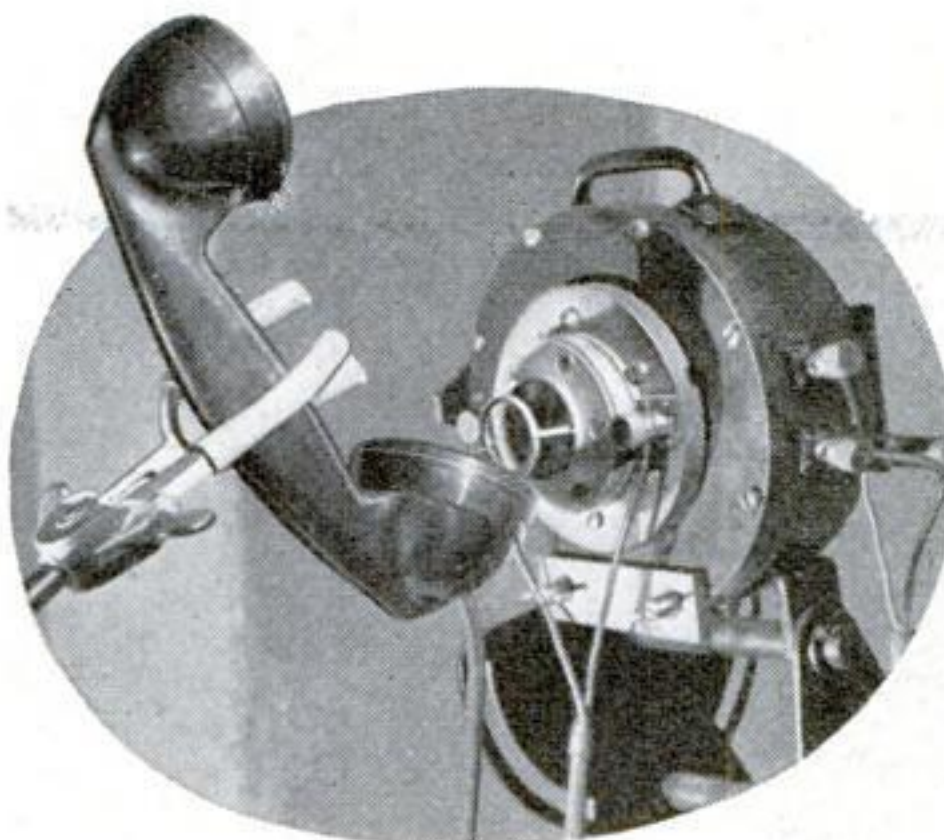
VOICE RECORDINGS HELP CORRECT SPEECH

STUDENTS at Northwestern University, Evanston, Ill., record their voices on phonograph disks in order to analyze and correct their speech. Dr. Paul Moore, director of the School of Speech at the University, explains that a speaker's voice generally sounds higher in pitch to other people than it does to himself. By recording his voice and studying its individual characteristics, a student is able to correct defects not only in pitch but also in enunciation and tonal quality. Records made at various intervals may be used to detect changes in speech.



College student making a recording of her voice

"ARTIFICIAL MOUTH" TESTS TELEPHONES



"Fingers" hold phone at the proper angle

TELEPHONE transmitters are tested with an "artificial mouth" recently developed by telephone engineers. Dial tones, voice, and sounds of varying frequency are produced in a special high-fidelity loudspeaker and directed into the transmitter. By comparing the known sound volume produced by the loudspeaker with that picked up by the phone transmitter, the efficiency of the latter instrument can be accurately determined.

Boys Build Battleships

IN NAVY-YARD APPRENTICE SCHOOLS

By KENNETH M. SWEZEY

IN A dozen navy yards and stations of the United States, from Portsmouth, N. H., to Cavite in the Philippine Islands, the Federal Government is conducting one of the least known, yet one of the most unique and thrilling, vocational-training institutions in the world. In the Navy Yard Apprentice Schools, more than 1,000 picked American boys work on projects ranging from hammocks and lifeboats to great bombing planes, sixteen-inch guns, Coast Guard cutters, and 10,000-ton cruisers.

Not merely students, but mechanics working on actual construction, Navy Yard apprentices are paid while they learn. Thirty-two hours a week they work in machine shops, mold lofts, foundries, aircraft factories, and on ships and shipways. The remaining eight hours they spend in classrooms, studying mathematics, drawings, English, and the theoretical foundations of their chosen trades.

For four years this intensive training, blending "learning by doing" with the most advanced programs of related mental instruction, goes on. At the end of that time, apprentices who have "made the grade" are given certificates of service, and their apprenticeship comes to an end.

Now recognized artisans, rating third-class mechanics' pay averaging more than

six dollars a day, their further advancement is limited only by character and ability. Hundreds of apprentice-school graduates have climbed to positions requiring skill and high responsibility. As first-class mechanics, estimators, shop masters and office executives, earning wages up to more than \$5,000 a year, these men form the backbone of the navy-yard civilian personnel, the men who are building the amazing new ships, armament, and aircraft of the United States Navy.

Although apprentice schools in the modern manner are creations of the last twenty-five years, apprentice training for naval shipbuilders has a long history. Joshua Humphreys himself, the pioneer naval builder of the United States, began his career at fourteen as an apprentice in Penrose's shipyards, on the Delaware River. In the construction of every vessel built in the navy yards of the United States since the days of the U.S.S. *Constitution*, apprentices have had a hand. From the building of the shipways to the

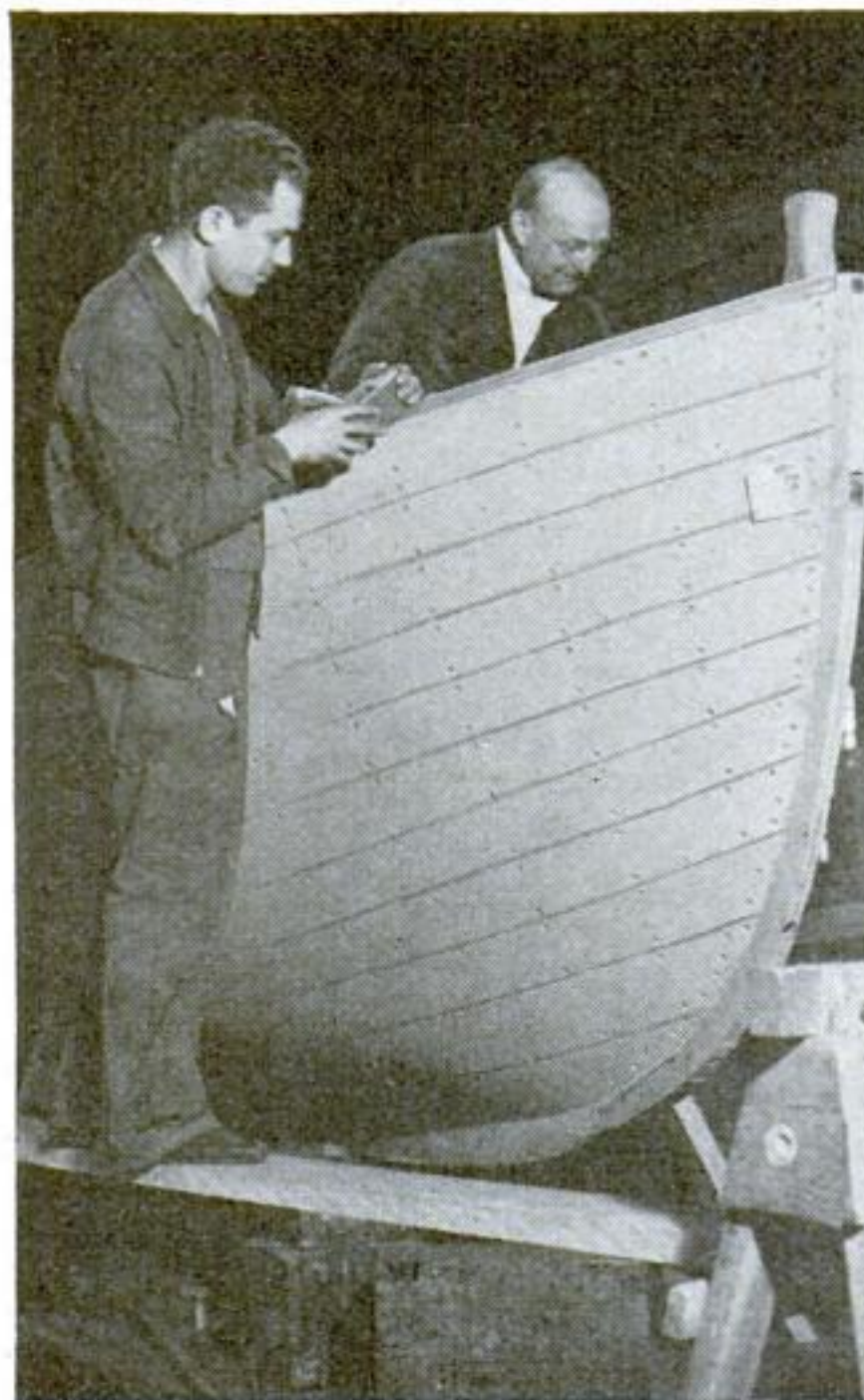
varnishing of the main truck, from the laying of steel keels to the casting of propellers and the making of boilers, apprentices, under the guidance of expert mechanics, have performed an important part of the skilled workmanship.

When the 10,000-ton cruisers *Philadelphia* and *Brooklyn* slid down the ways in the yards whose names they bear, a few weeks ago, thousands of hours of apprentice labor had helped in their making. Apprentice ship fitters helped lay out templates in the mold loft, form framing and plating in the shops, work on the actual construction; apprentice shipwrights laid decking, made wooden spars, applied interior woodwork; apprentice electricians wound motors, wired the cruisers for light, power, and signaling systems; apprentice boiler makers tubed boilers, made tanks, welded huge flues.

Before these cruisers are finally ready to sail, boats, propellers, guns, paint, piping, awnings, hammocks, and even flags, will all have been projects in the training of the future master builders of the Navy.

In the time of Joshua Humphreys, shipyard craftsmen were allowed to select their own apprentices and to bring them to work with them under private contracts of apprenticeship. In 1852, John P. Kennedy, then Secretary of the Navy, abolished this practice and made apprentices wards of the Navy Department, selected for fitness by a board of examiners and given systematic training by competent instructors.

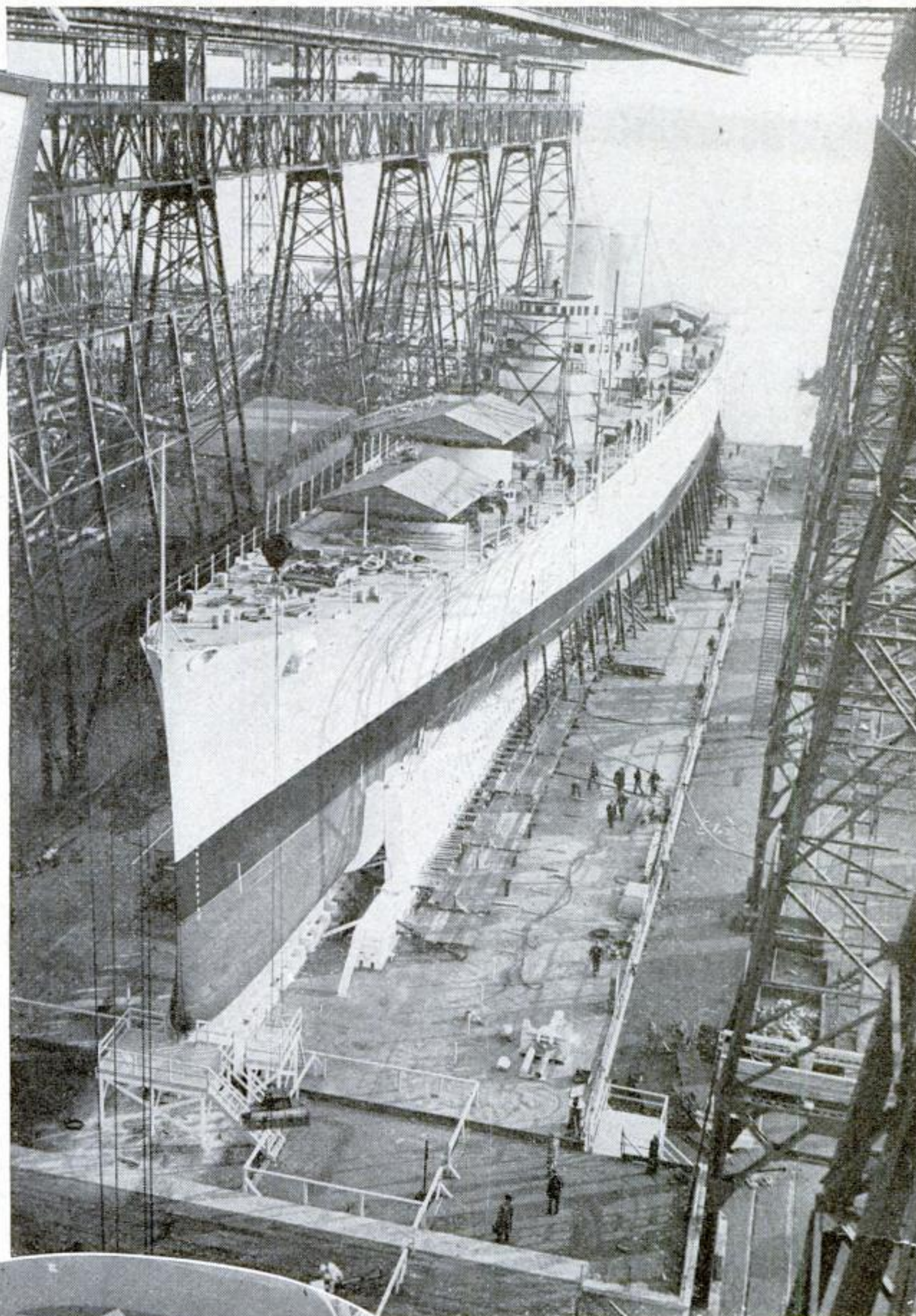
The modern apprentice-school system, however, with its classrooms and related mental training, has been a development brought about by the era of steel dreadnoughts driven by steam. In the days of sails and wooden ships, a strong arm and a careful



How navy-yard apprentices learn by doing: Above, a student boat builder at work on a whaleboat; in circle, an embryo coppersmith forming the back for a large exhaust pipe; right, boys receiving instruction in mechanical drawing in a classroom at the Brooklyn Navy Yard school for apprentices



All boys who complete their courses are given these certificates



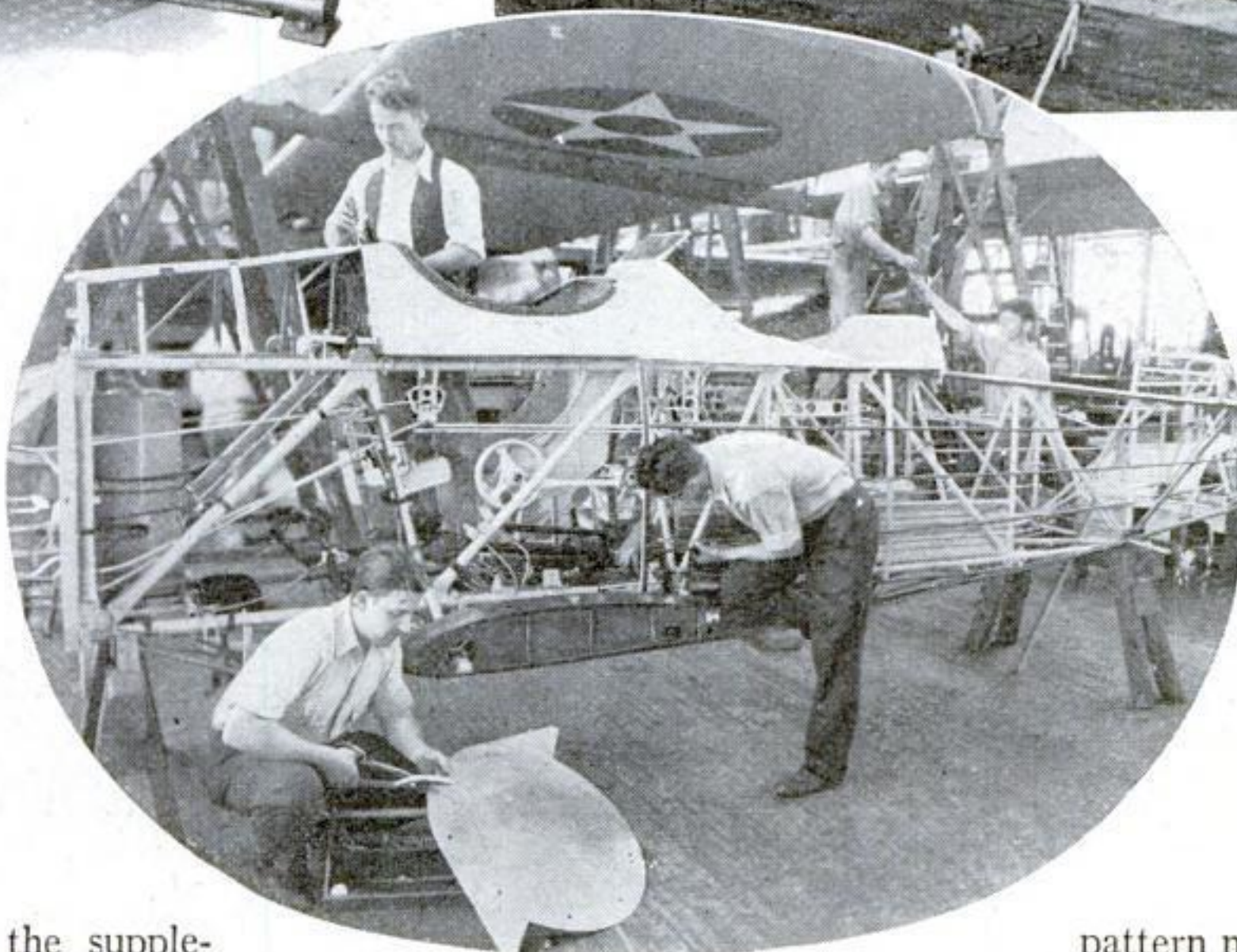
The U.S.S. *Philadelphia*, one of Uncle Sam's new cruisers built with the help of navy-yard apprentices, before her launching at the Philadelphia Navy Yard

A student adjusting an airplane engine. Right, boys assembling the fuselage of a fast Navy plane

eye, mixed with common sense and a dab of the "three R's," made good material for any of the few shipbuilding trades. The coming of steel and steam changed all this. Almost overnight, shipbuilding became a complex science demanding several dozen new skills, backed by first-rate technical knowledge.

At first, night trades schools were called upon to supply the supplementary theoretical training. In 1912, to meet more fully the varied and specialized needs of shipyard workers, the Navy Department authorized the establishment of regular schools right in the yards. The passage of the Smith-Hughes Act, in 1917, providing Government funds to be used toward the salaries of teachers in vocational-training schools, permitted the schools to be brought to a still higher standard of efficiency. By virtue of this Act, local Boards of Education were enabled to cooperate with the Navy Department by supplying experienced teachers.

Apprentice schools are now in full op-



eration in the navy yards and stations at Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; Philadelphia, Pa.; Washington, D. C.; Norfolk, Va.; Charleston, S. C.; Mare Island, Calif.; Puget Sound, Wash.; Pearl Harbor, Hawaii; Cavite, Philippine Islands; and the Naval Torpedo Station, Newport, R. I. Apprentices for trades in the Naval Gun Factory at Washington, D. C., and the Naval Aircraft Factory, at Philadelphia, Pa., also are trained in the schools of their respective yards.

The amazing complexity of modern

naval construction is demonstrated by the number of trades offered apprentices. Not only may these boys learn to be expert shipwrights, molders, blacksmiths, painters, coppersmiths, boat builders, and sail makers—traditional shipbuilding trades—but they may train to become airplane mechanics, electricians, boiler makers, sheet-metal workers, ship fitters,

pattern makers, plumbers, pipe fitters, machinists, diesinkers, or joiners.

To be eligible for admission to one of these schools, a boy must be between sixteen and twenty-two years old, a citizen of the United States, physically sound, mentally capable, and in good health. Whenever more eligibles are needed, examinations are held by the U.S. Civil Service Commission. These consist of written tests relating to the trades concerned. According to ratings received in these examinations, candidates are called to fill apprentice vacancies, which occur in July and December immediately following the semi-

(Continued on page 127)



Knocked-down glider attached to cable car for trip to mountain summit

GLIDER RIDES CABLE CAR TO PEAK

IN ORDER to gain the greatest possible altitude for a take-off, Austrian flying enthusiasts recently transported their glider to the top of a 4,000-foot mountain peak by means of a cable railway. With the machine completely dismantled, its wings were strapped to the bottom of the cable car and its fuselage to the side. At the summit, the sections were detached, and the glider was assembled and launched. The high start gave the pilot an opportunity to seek favorable air currents that would prolong his flight.



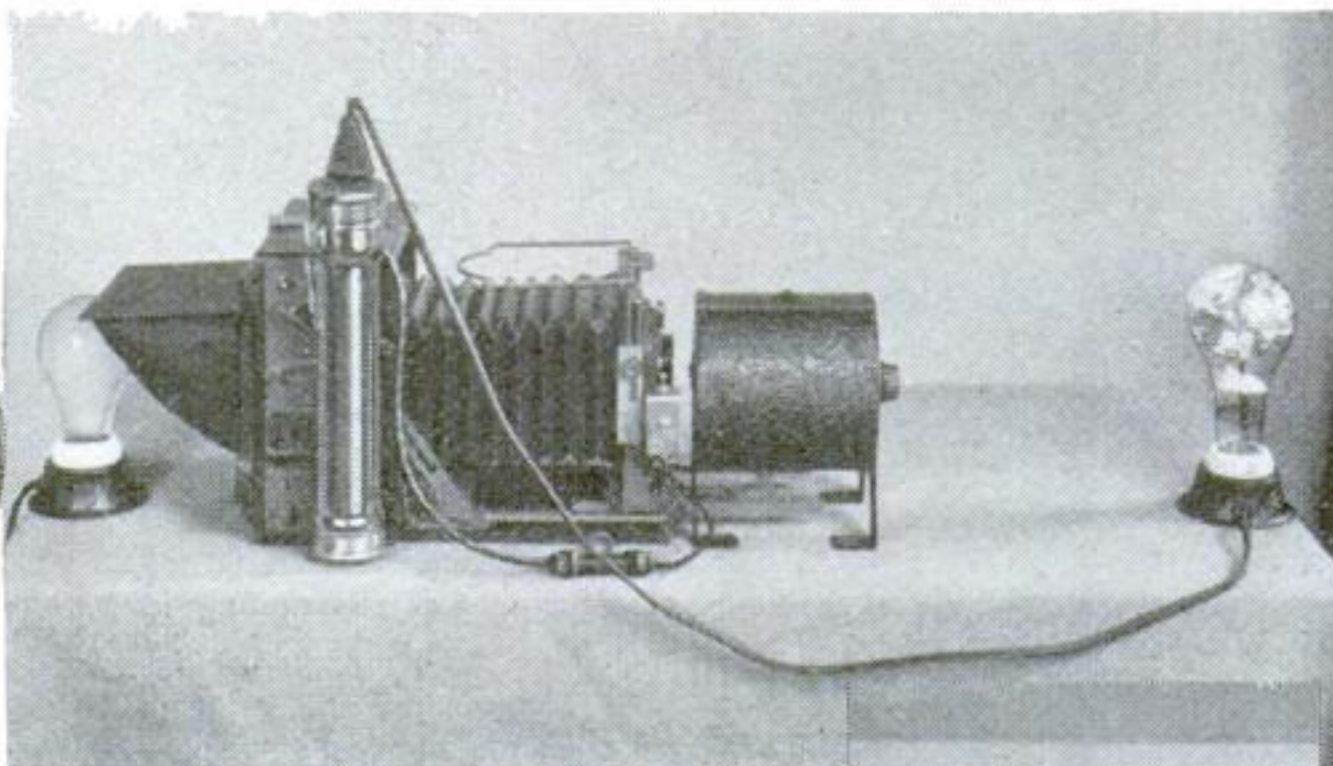
Homemade snowplow in use for clearing walk

HOMEMADE SNOWPLOW IS ELECTRIC

UTILIZING a small electric motor salvaged from a washing machine, Lewis Larsen of Minneapolis, Minn., constructed the homemade snowplow shown in the photograph above. When it is pushed along the sidewalk, a metal apron on the machine scoops up snow and feeds it to whirling, motor-driven metal blades which force it out through an adjustable chute. An eighteen-inch swath can be cleared at one time.

SYNCHRONIZER TIMES CAMERA SHUTTER

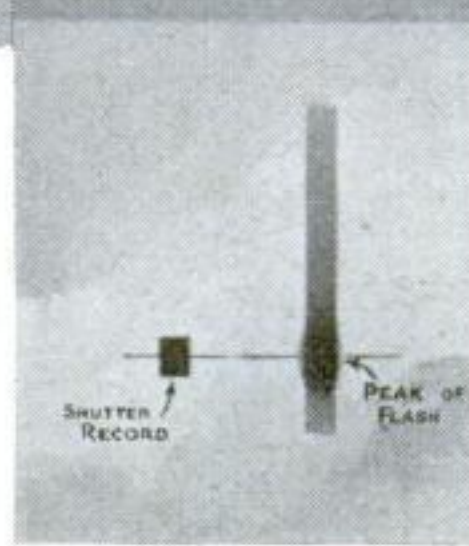
This device shows relation of shutter time to bulb flash



BY USING a new synchronizing device invented by General Electric engineers, photographers who take action pictures by photoflash light can set their shutters to open at the precise moment when light from the flash bulb is at its brightest. This permits fully exposed negatives at speeds up to 1/200th of a second.

The device consists of a small metal drum with a round opening in either end and a piece of cut film held in a compartment on one side of the curved outer housing. When the trigger of the flash gun, operating the shutter and setting off the flash bulb, is pressed, light from the photoflash bulb enters one end of the drum while rays from a photoflood lamp back of the camera pass through the lens and shutter into the other end of the drum. Reflected onto the film by prisms and a spinning rotor, the light rays from both sources produce parallel tracks, one short and one long, on the film. This shows just when the shutter is opening in relation to the peak light of the flash. The shutter-release mechanism on the flash gun can then be adjusted until the shutter opens at the moment of highest light intensity.

Light from a flood lamp placed behind the camera passes through the shutter and leaves a record on a film for comparison with a light track made by the flash bulb, as at right



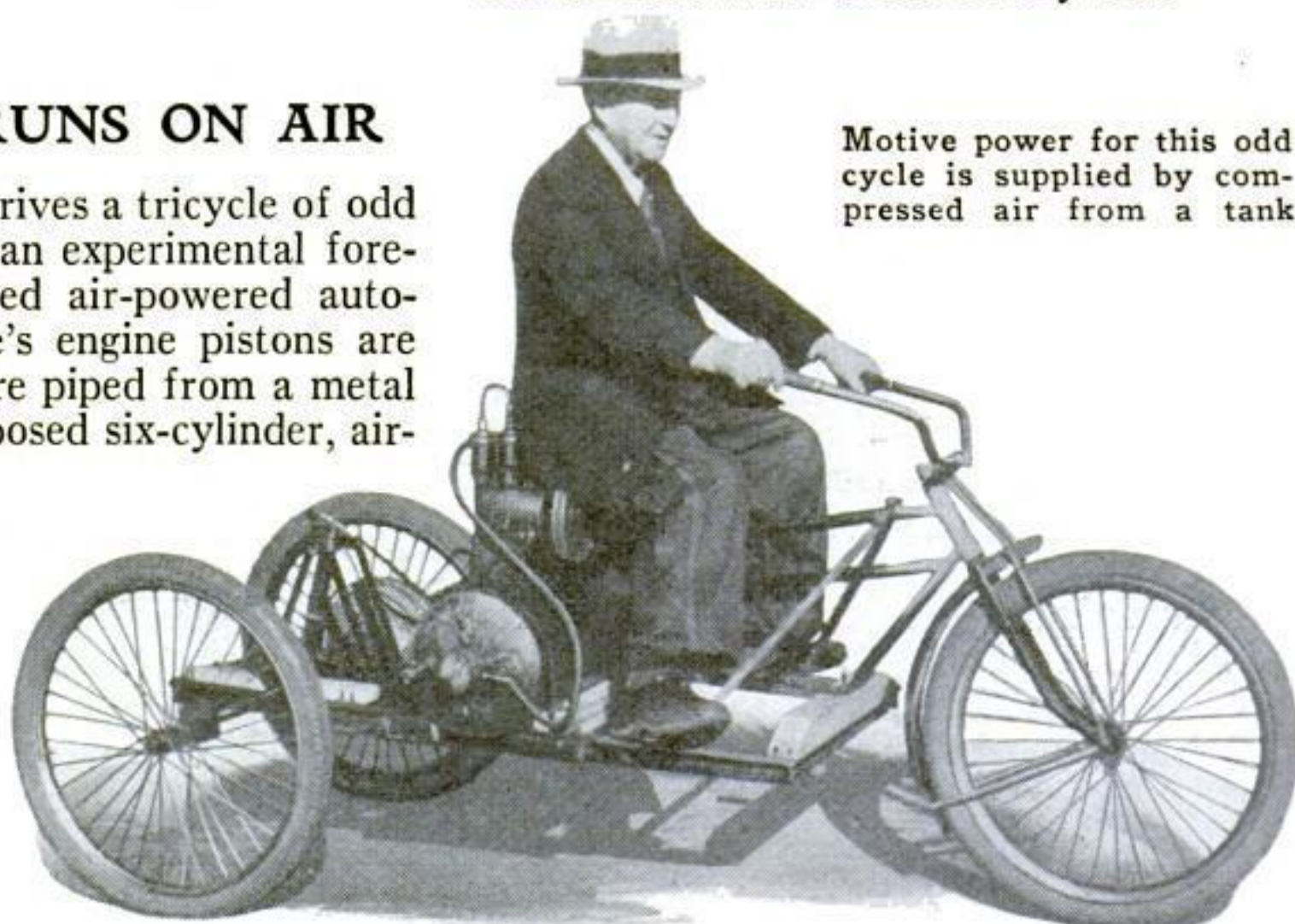
STRETCHES TIGHT SHOES

SHOES can be stretched at any point where they are tight with a new device. Made of metal, the adjustable shoe stretcher has a double sole which can be fitted to any width shoe; turning a thumb-screw forces forward an adjustable lever with a bulb-shaped end, and stretches the leather at the desired spot. The device can be used with shoes of any size.



TRICYCLE RUNS ON AIR

COMPRESSED AIR drives a tricycle of odd design developed as an experimental forerunner to a projected air-powered automobile. The vehicle's engine pistons are driven by air pressure piped from a metal storage tank. A proposed six-cylinder, air-powered car designed on the same principle will have air compressors replacing conventional springs to generate "fuel" for the air motor as they are operated by bumps in the road.



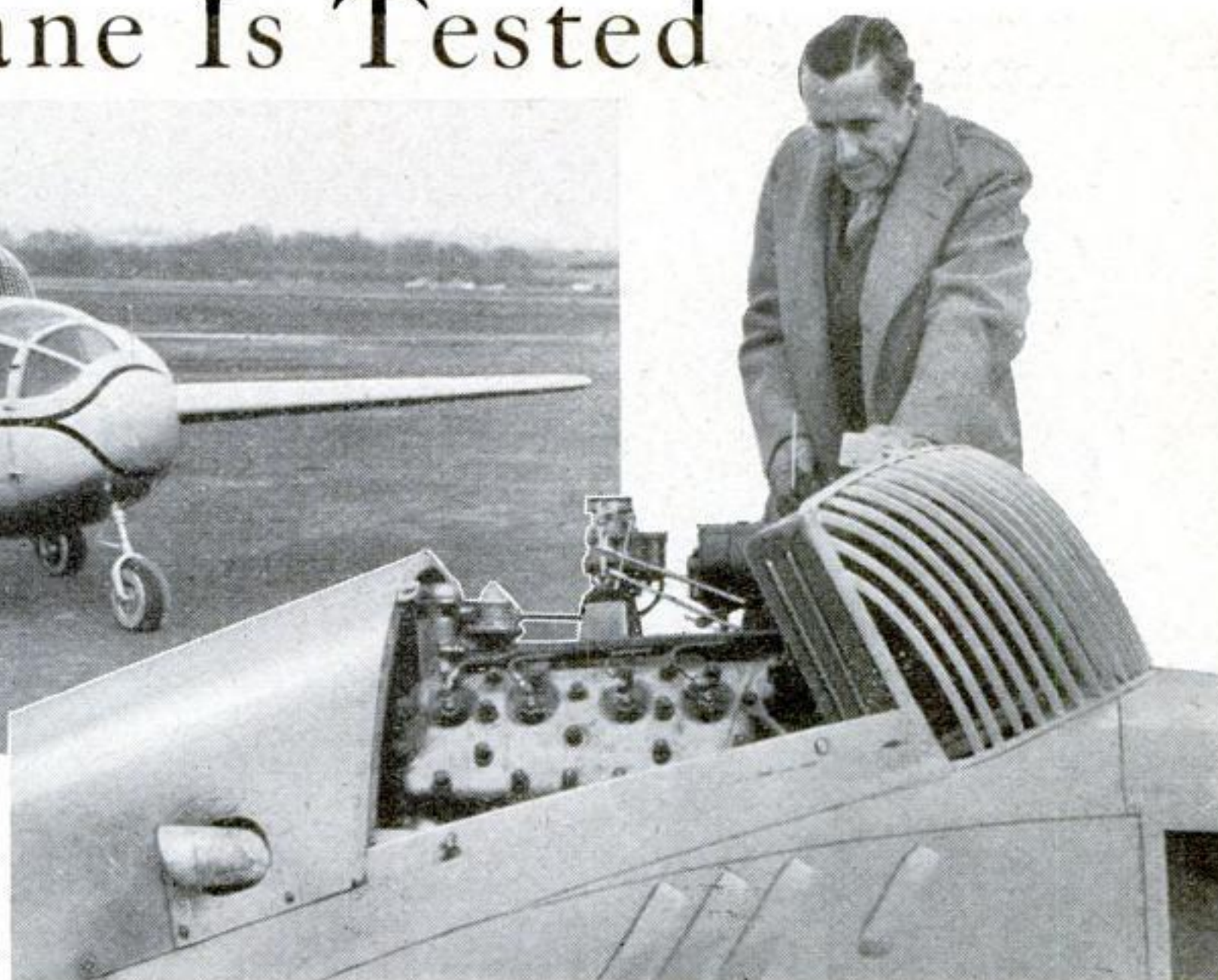
Motive power for this odd cycle is supplied by compressed air from a tank

New "Flivver" Plane Is Tested



POWERED by a standard low-priced automobile engine, one of the latest types of "flivver" airplanes was recently delivered for inspection to U. S. Department of Commerce officials in Washington, D. C. Developed by Hayden Campbell of St. Joseph, Mo., to bring the airplane into a lower price range, the craft has a wing spread of thirty-six feet and is said to average about sixteen miles to a gallon

This inexpensive small plane is powered by the automobile engine shown in the picture at right



of gasoline. Of all-metal construction, the pusher-type plane is equipped with a forward landing wheel to prevent inexpert pilots from "nosing over" the plane on

rough ground. Cruising at ninety-five miles an hour, the craft will reach a top speed of 112 miles an hour. It can take off with a run of 350 feet.

BLAST 1,000,000-TON MARBLE BLOCK

WEIGHING more than 7,000 times as much as a modern steam locomotive, a gigantic block of marble was recently blasted from a famous Italian quarry in one piece. Dislodging the 1,000,000-ton chunk of stone required the simultaneous explosion of 120 heavy charges of dynamite. It is estimated that it will take 2,000 workmen six years to cut up the marble into standard sections for shipment to foreign countries.



Spectators watching as the explosion of 120 heavy charges of dynamite chopped a 1,000,000-ton chunk of marble from an Italian mountain side



Streamline golf club, compared with a driver of more conventional design

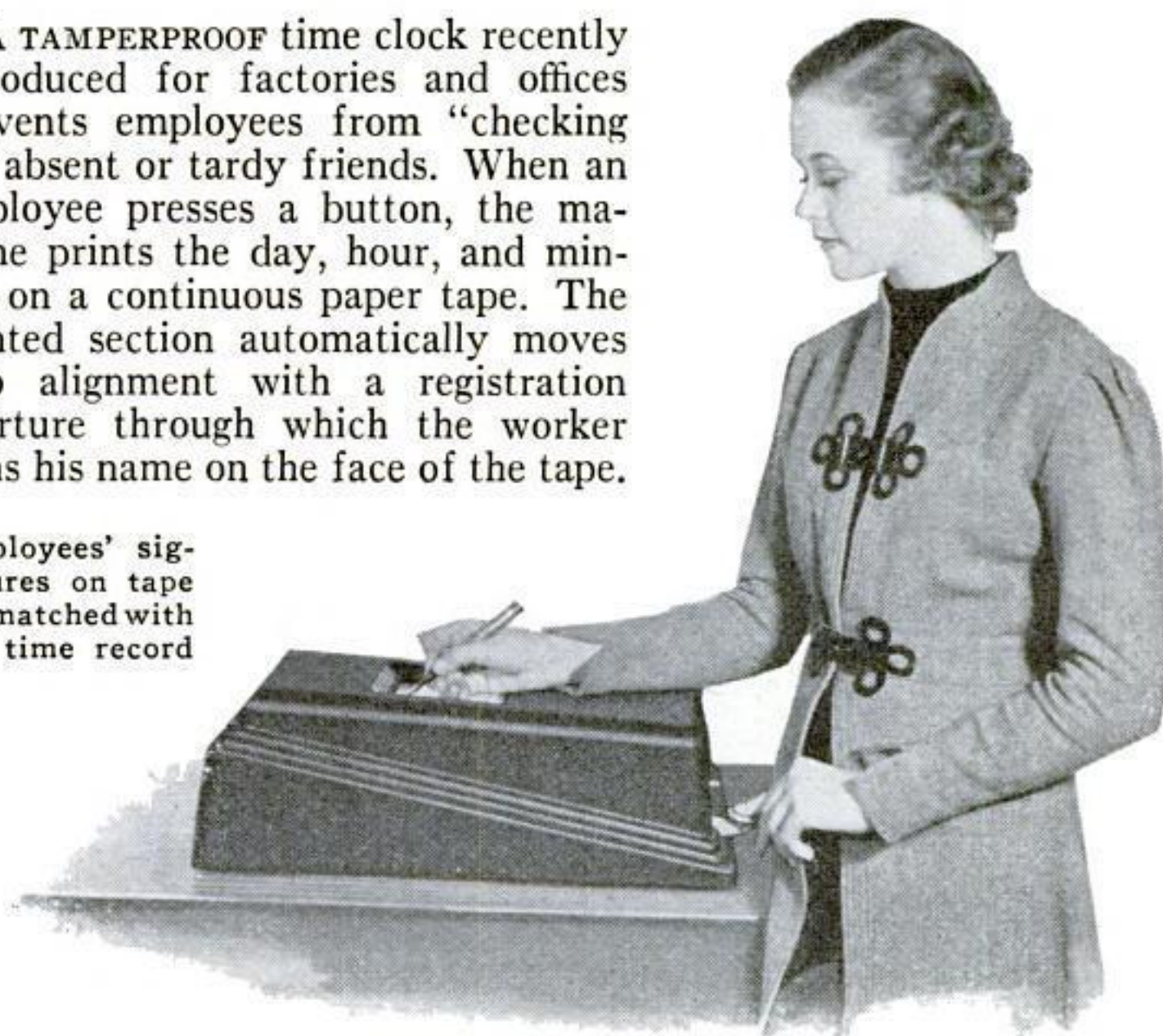
STREAMLINE CLUB AIDS GOLF DRIVE

SCIENCE has streamlined the golf club. Designed by a golf-playing physicist, a new club is shaped like a bullet to decrease air resistance during the golfer's swing, thus letting the club head strike the ball with greater velocity. Average golfers using the new club are said to have increased the distance of their drives from ten to fifteen yards. As proof of the value of streamlining, it is pointed out that, in driving, an ordinary player swings a conventional driver at a maximum velocity of about 100 miles an hour, while an expert's club head may reach as high as 120 miles an hour.

TIME CLOCK IS TAMPERPROOF

A TAMPERPROOF time clock recently introduced for factories and offices prevents employees from "checking in" absent or tardy friends. When an employee presses a button, the machine prints the day, hour, and minute on a continuous paper tape. The printed section automatically moves into alignment with a registration aperture through which the worker signs his name on the face of the tape.

Employees' signatures on tape are matched with the time record



Outboard Drives Odd Water Sled



John W. Greenwood, of Oakland, Calif., on his outboard-powered water sled. At left, a close-up of the unique craft

BUILT to resemble a toboggan, a unique water sled constructed by John W. Greenwood of Oakland, Calif., skims over the water at a top speed of thirty-two

miles an hour. The craft weighs only sixty-five pounds, including its fourteen-horsepower outboard motor, which is clamped in a notch cut out of the stern

of the hull. The operator lies prone on the deck and steers the craft sled-fashion with a crossbar that is connected to the steering mechanism of the motor by means of ropes. The toboggan effect of the unusual water sled is heightened by a low railing which runs along either side of the deck. It is said that the water sled handles easily on sharp turns and gives as thrilling a ride as a real sled.

This is the long and short of harmonicas



LARGEST AND SMALLEST HARMONICAS COMPARED

WHAT are believed to be the largest and smallest harmonicas in the world are displayed in the photograph above. The small mouth organ has only the tones of a single octave, while the larger one has a range equal to that of a full-size piano.

COLLECTION OF OLD WATCHES SEEKS AN OWNER

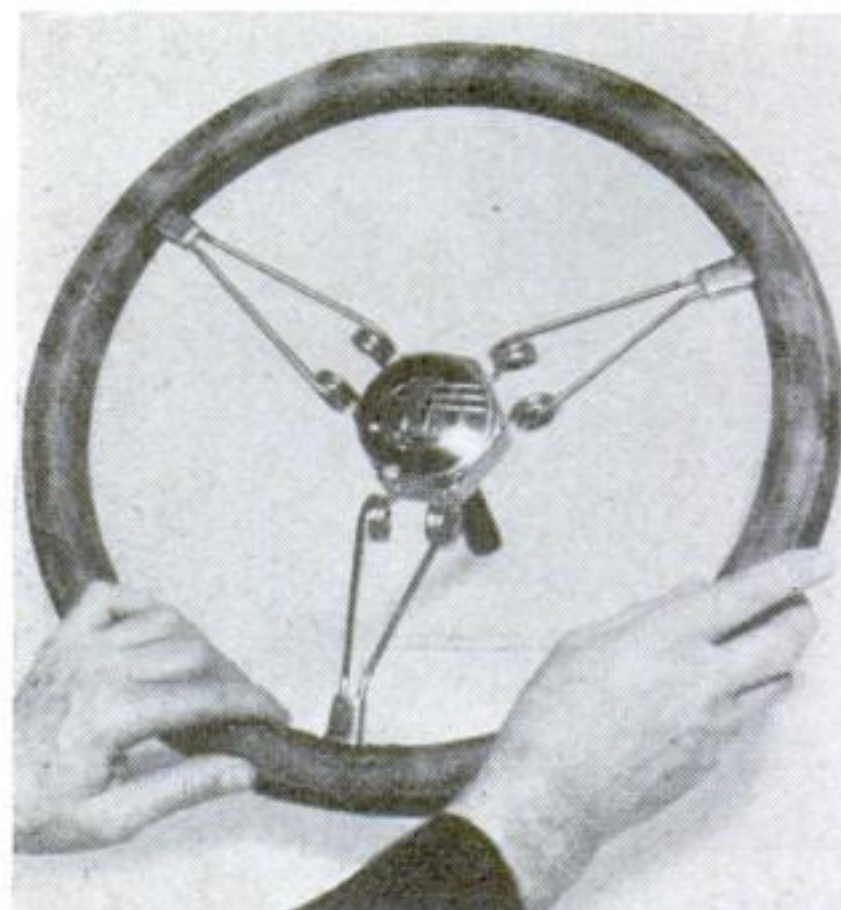
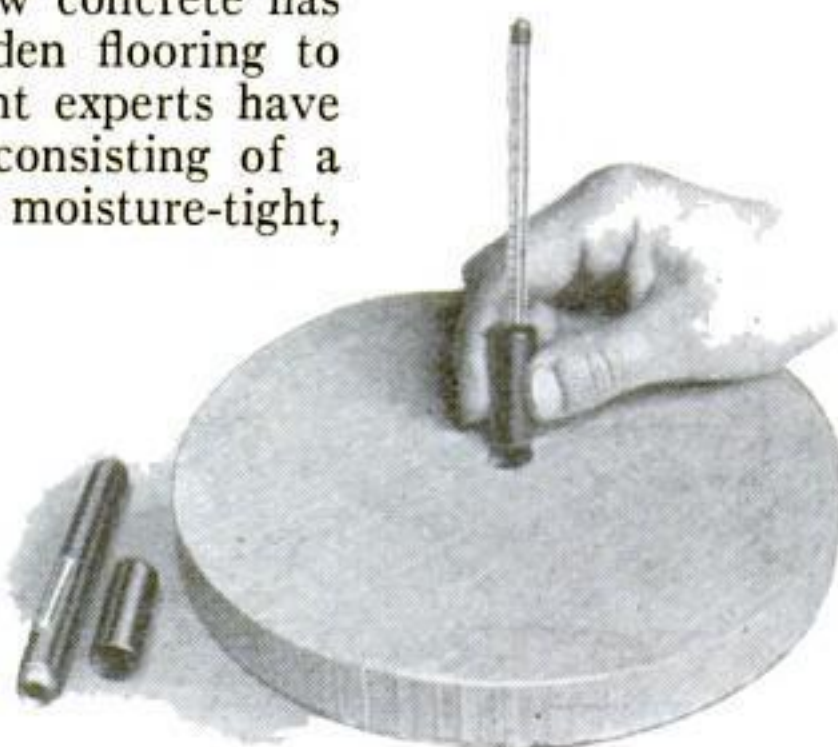
FOUR HUNDRED watches of various sizes and types were included in the estate of Joseph Vasek, who died in Los Angeles, Calif., recently without leaving a will. Temporarily held by a public administrator, the timepieces are mostly antiques, some dating as far back as the end of the seventeenth century. One of the most valuable of the watches in the collection was made in 1700 by James Lloyd, a well known watchmaker of London, England. If no heirs put in an appearance to claim the 400 valuable watches, the collection may be offered for sale to a public museum.



A collector's death left these 400 antique watches unclaimed

GAUGE SHOWS WHEN CONCRETE IS DRY

TO DETERMINE when new concrete has dried sufficiently for wooden flooring to be laid over it, Government experts have developed an instrument consisting of a humidity gauge set in a moisture-tight, disk-shaped shield. When the shield is laid over concrete, the gauge responds to moisture evaporation, showing whether flooring can be laid without danger of swelling and buckling. The device is shown in use at the right.



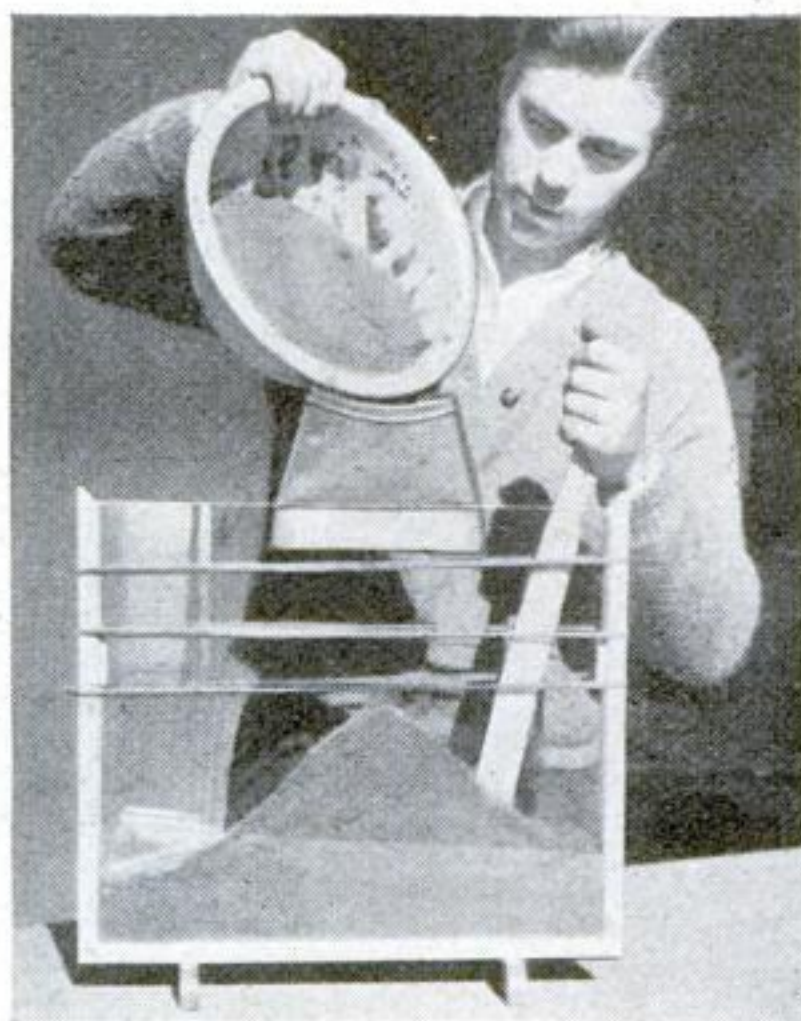
In a wreck, spokes bend to prevent injury

SPRINGS MAKE WHEEL SAFE

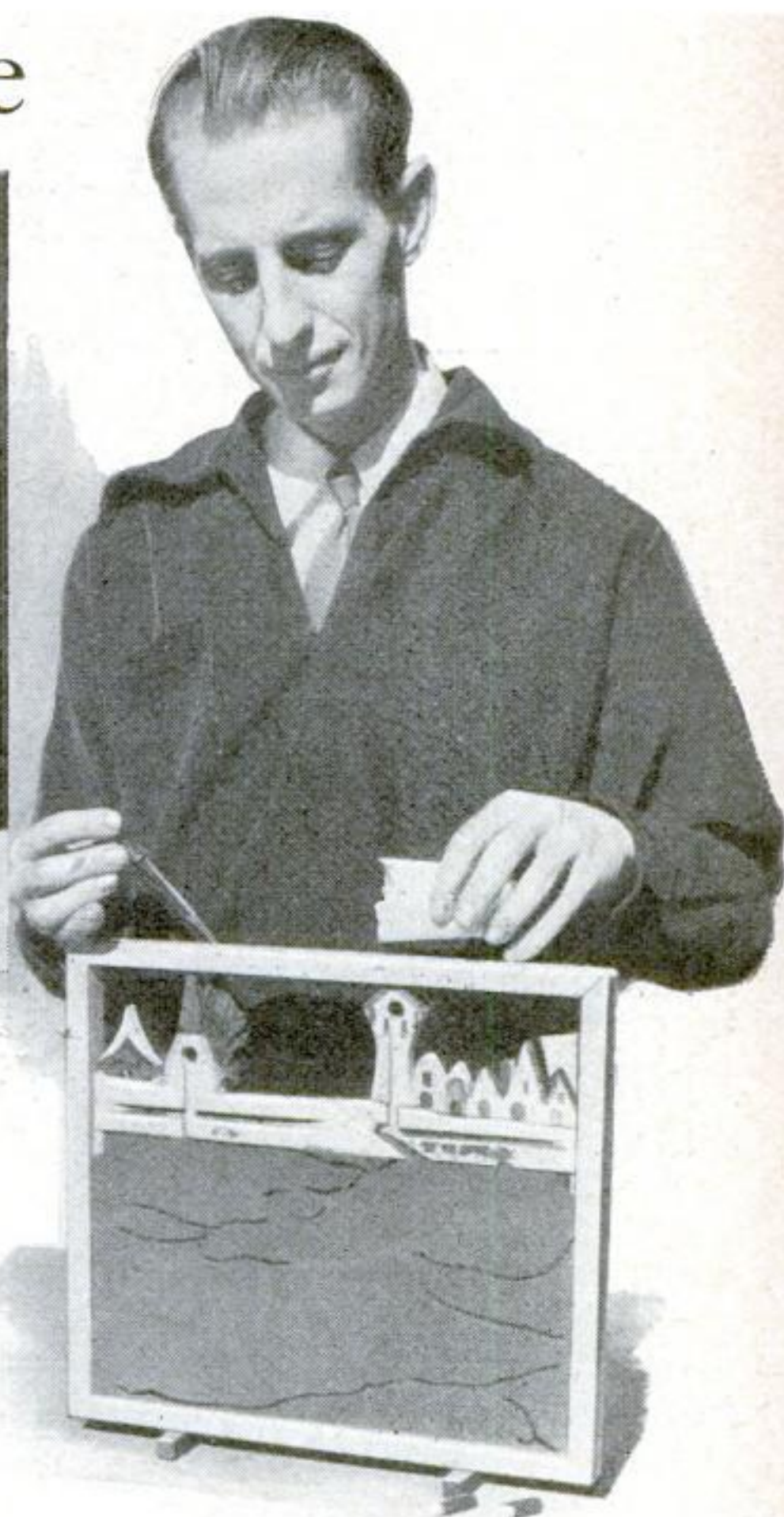
STEEL SPRINGS replace solid spokes in a new safety steering wheel that can be attached to the steering post of any automobile. In case of a serious accident, the springs bend and "give," preventing the wheel rim from injuring the driver. In ordinary driving, they are said to cushion road shocks.

Ant Homes Show Insect Life

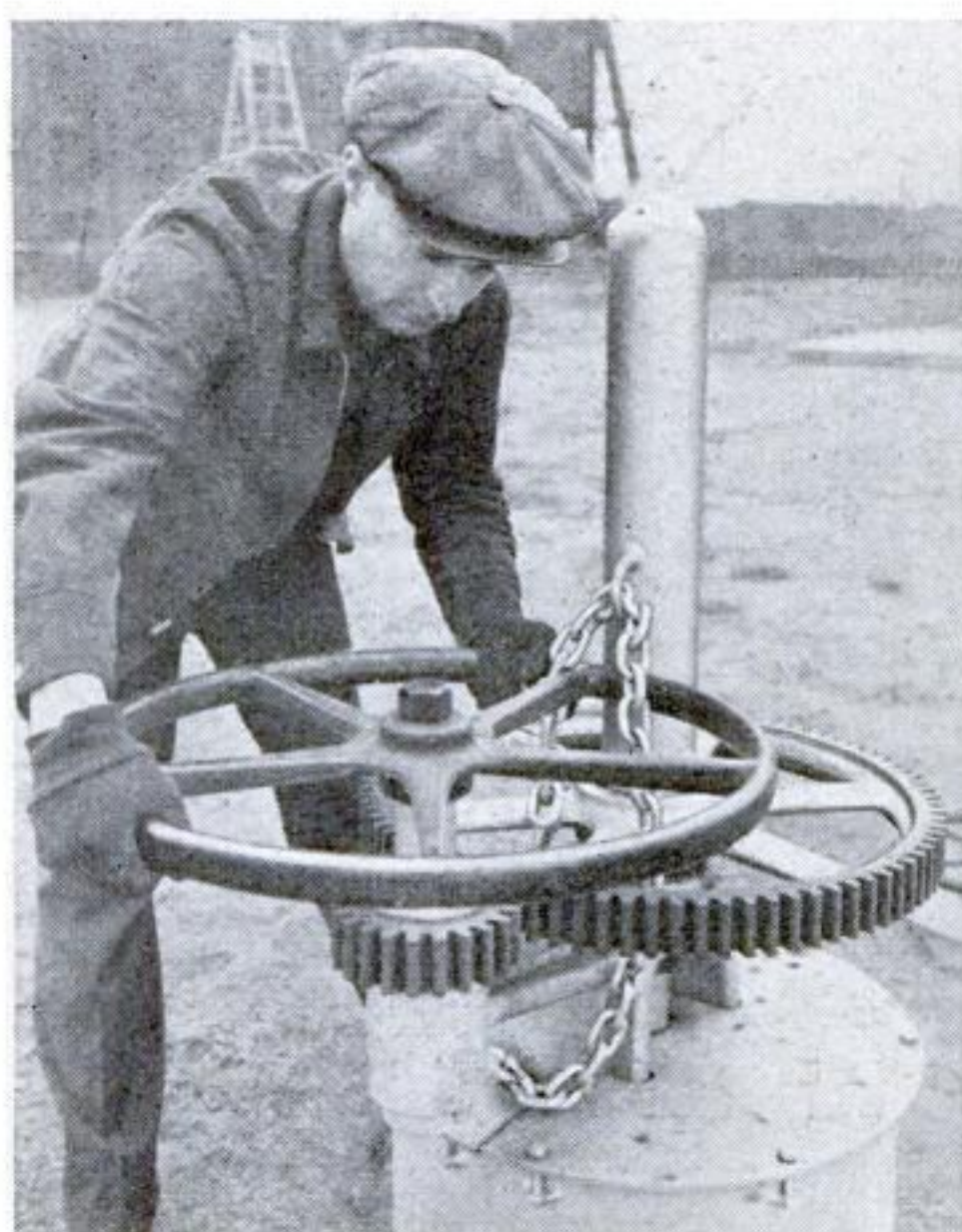
FIVE MILLION live harvester ants, captured with spoons, inhabit 50,000 miniature "villages" constructed by a Monterey Park, Calif., craftsman and workmen under his direction. Inspired by his own observation of the insects at work near his home, he has designed ant houses with glass walls that expose to view all the underground activities of the insect colony. The narrow inclosures of wood and glass contain earth that has been screened, moistened, and packed tightly to prevent cave-ins when the ants start tunneling. Gayly painted cut-outs, representing homes and buildings, add a decorative touch. From ten to 200 ants are placed in each "village," according to its size. Food is provided by weed seeds mixed with the earth, and a medicine dropper applies moisture, as needed, to a sponge which serves as a reservoir. Through the transparent walls, observers can watch the ants dig burrows, build rooms, store food, care for their young, fight battles, and bury their dead. The harvester ant is specially suited for use in the man-made insect colonies because it does not attack wood, and therefore cannot destroy the many wooden parts of the "village."



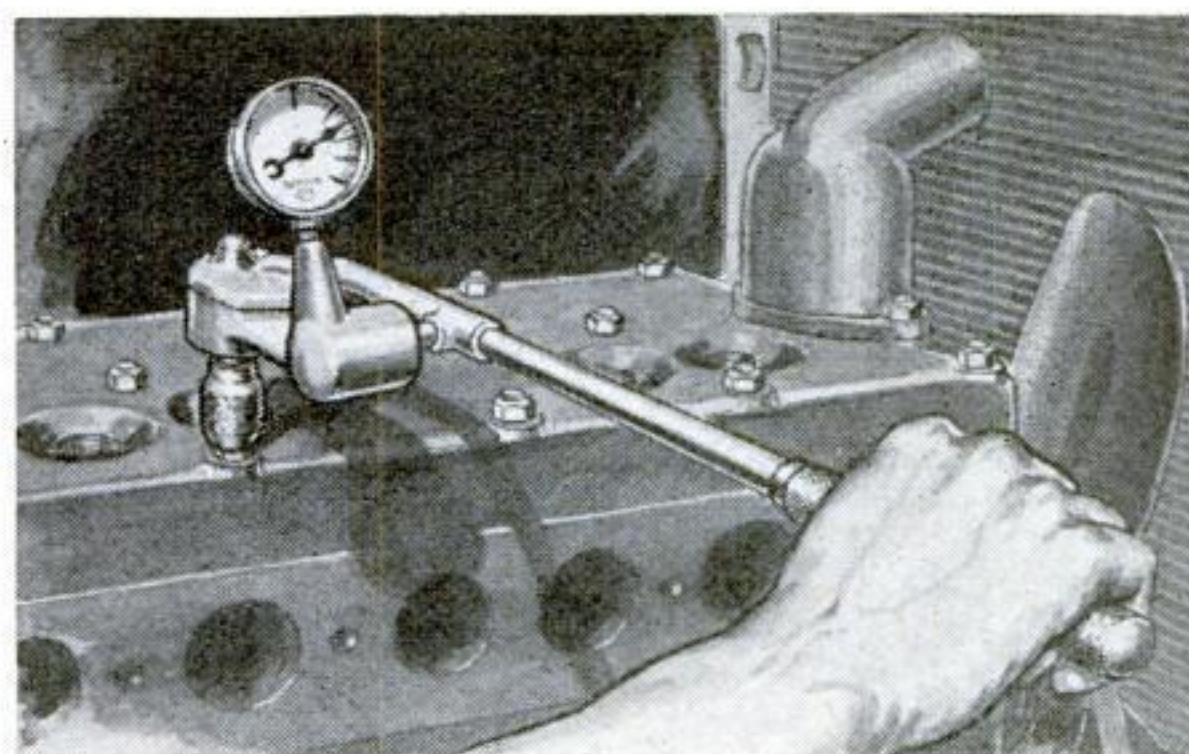
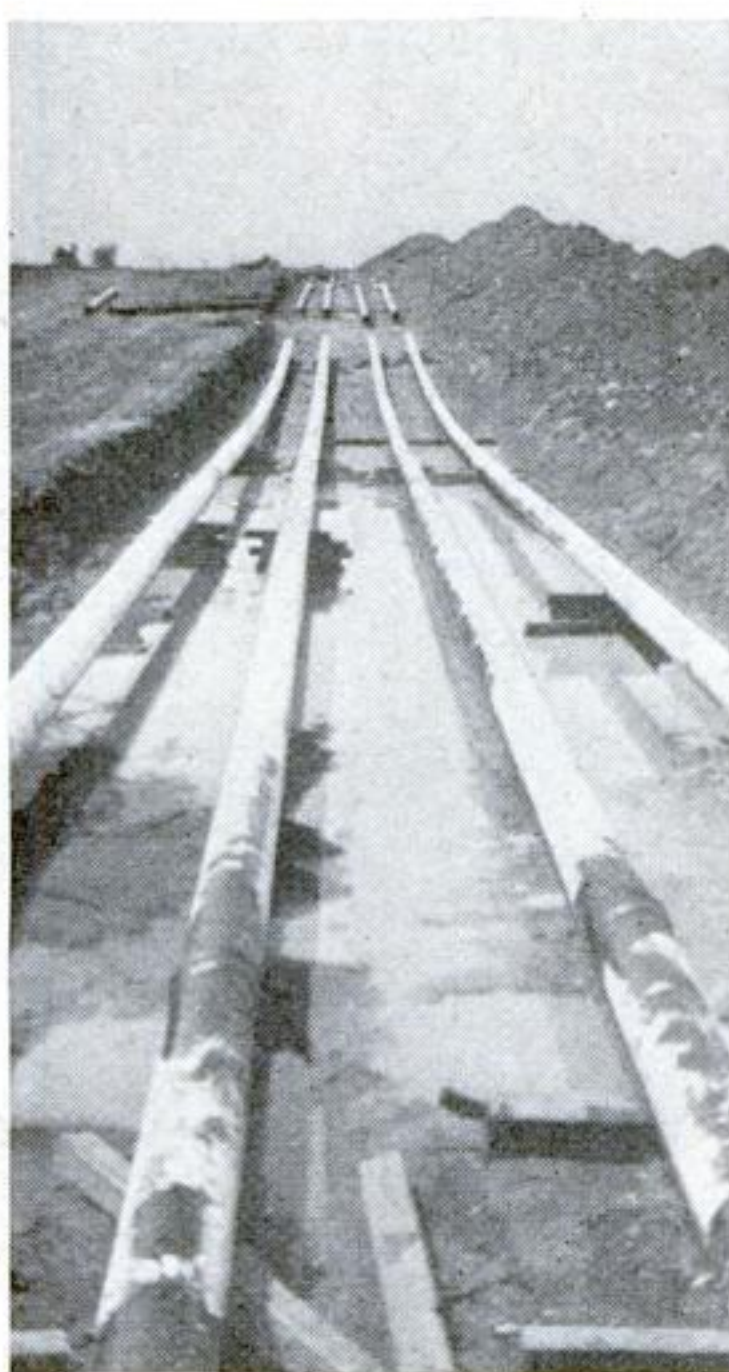
Screened earth being poured between panes of glass to form an ant "village." At left, capturing ants in a spoon. Right, the completed "village" is supplied with water through a medicine dropper, and with seeds for food.



PIPES BRING GAS 1,200 MILES



This valve controls the supply of natural gas piped to Detroit, Mich., from Texas. A section of the 1,200-mile line is pictured at the right.



WRENCH HAS PRESSURE GAUGE

WHEN is a nut tight? A new socket wrench with a built-in dial, which shows the exact amount of pressure being applied, eliminates the uncertainty of depending upon a sense of "feel." The tool is declared especially useful when all the nuts on a single job are to be adjusted uniformly, as in tightening the studs of a reconditioned cylinder head for an automobile motor. Turning each nut until the dial registers a desired tension avoids distorting the block, which would cause improper piston clearances that result in low engine efficiency.

WITH the completion of the longest gas pipe line in the world, Detroit, Mich. becomes the latest great city to enjoy the advantages of natural gas. The conduit delivers 60,000,000 cubic feet a day, piped across the country under high pressure from wells in the Panhandle region of Texas. Detroit's 1,500,000 gas-burning appliances, which formerly consumed manufactured gas, had to be fitted with new burners at a cost of \$2,000,000 to the local gas company, but it is expected that increased consumption will soon offset the outlay. Natural gas costs the householder less for each cubic foot and contains twice as much heat as manufactured gas.

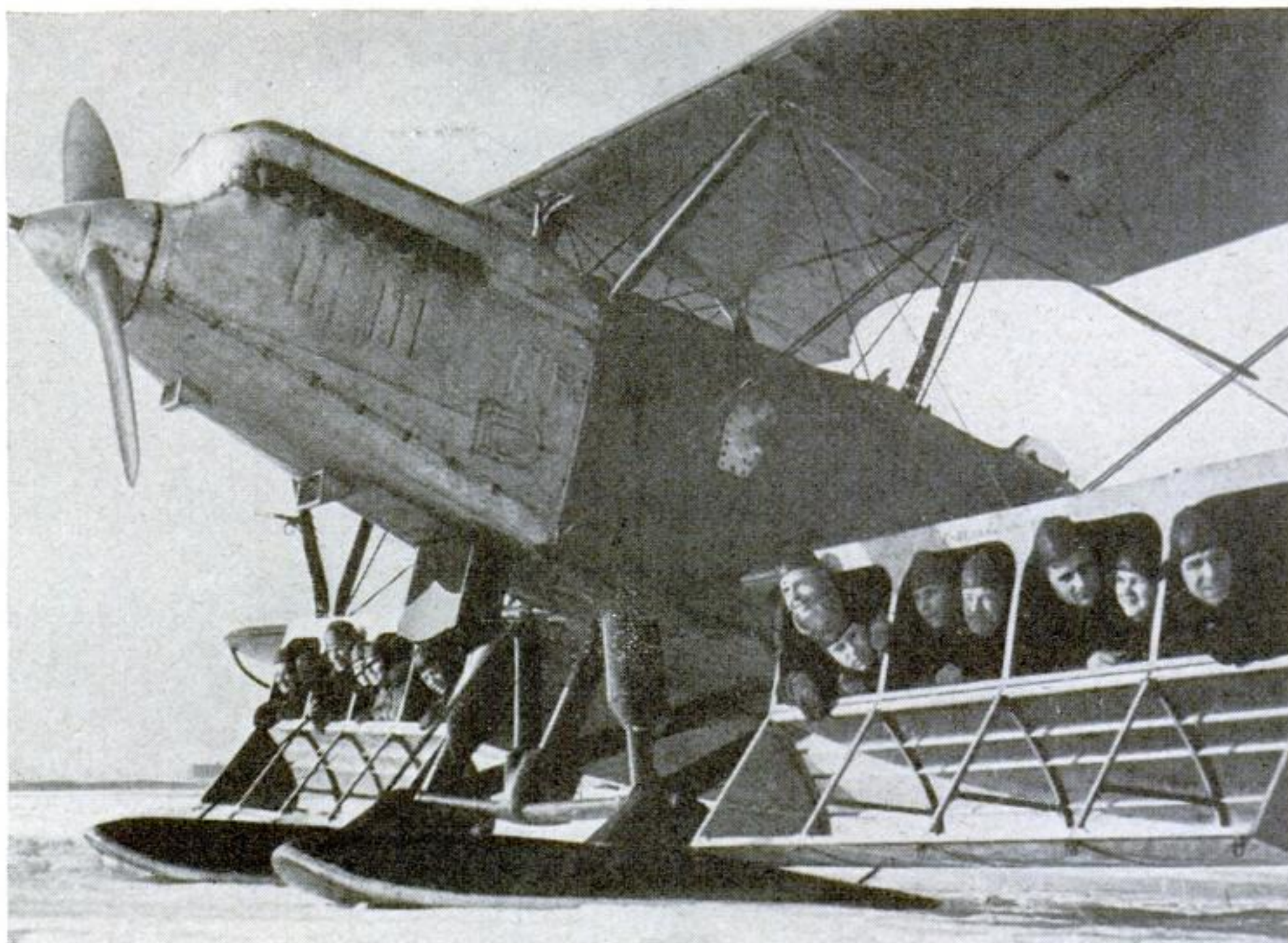


PORTABLE PHONES USE LIGHTING CIRCUIT

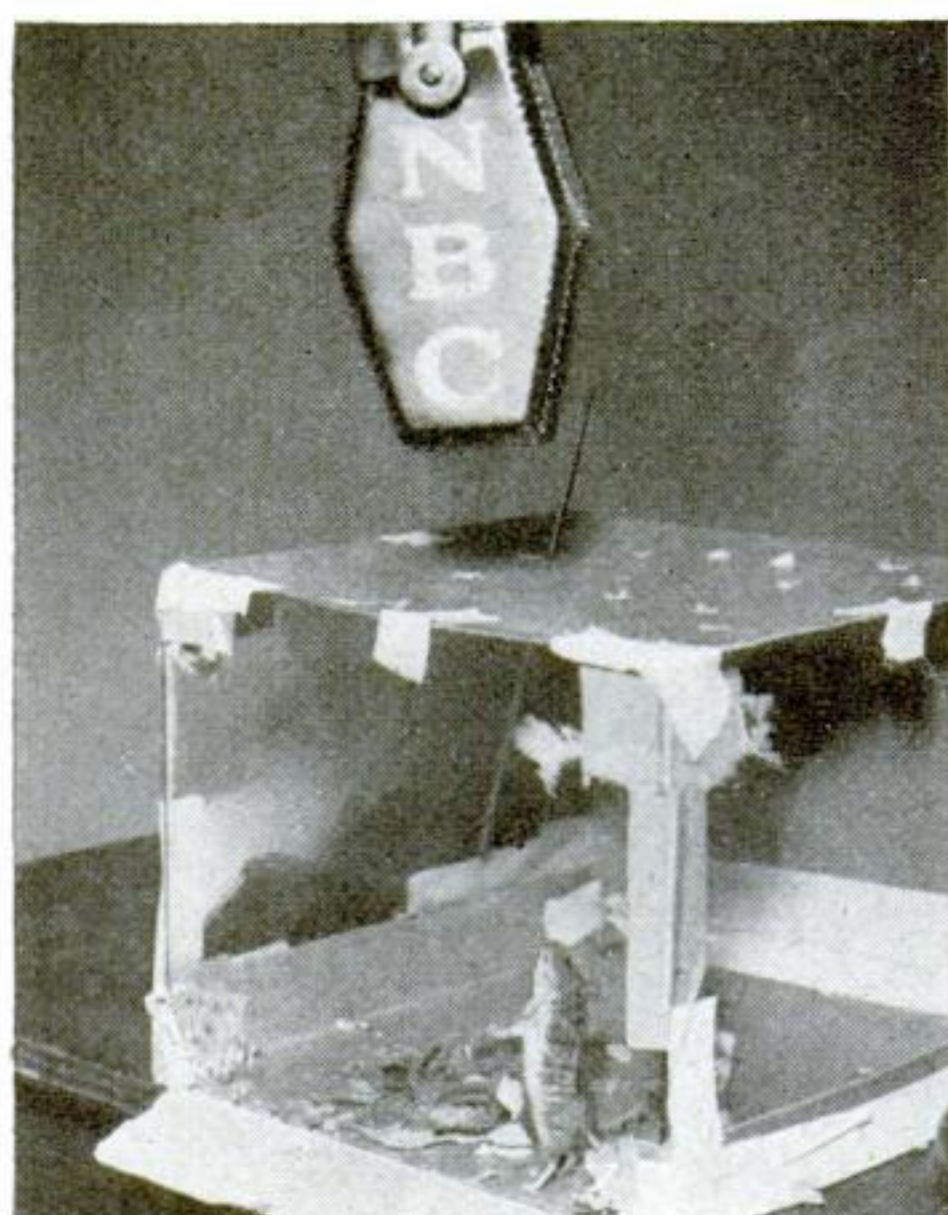
A COMPLETE, portable communication system for home, office, or factory is provided by a pair of telephones of new design which require no interconnecting wires. When the radio-like instruments are plugged into any convenient light sockets or wall outlets, each one becomes a combination transmitter and receiver, the wires of the electric-lighting system serving as the transmission line.

Sixteen Men Ride Under Plane's Wing

ORIGINALLY designed as a two-seater, a small Russian biplane has been remodeled into an emergency transport capable of carrying sixteen passengers. Eight men slide into compartments constructed on the underside of each lower wing, and are protected by a hinged, streamline wind screen. The experimental craft was developed as an aid to the Soviet military experiment of flying parachute-equipped troops behind enemy lines (P.S.M., Feb., '36, p. 38), and also as a possible means of transporting freight economically. In a test flight, the unique transport is said to have reached a speed of 180 miles an hour.



Russian plane equipped with compartments under its lower wing for carrying soldiers or freight

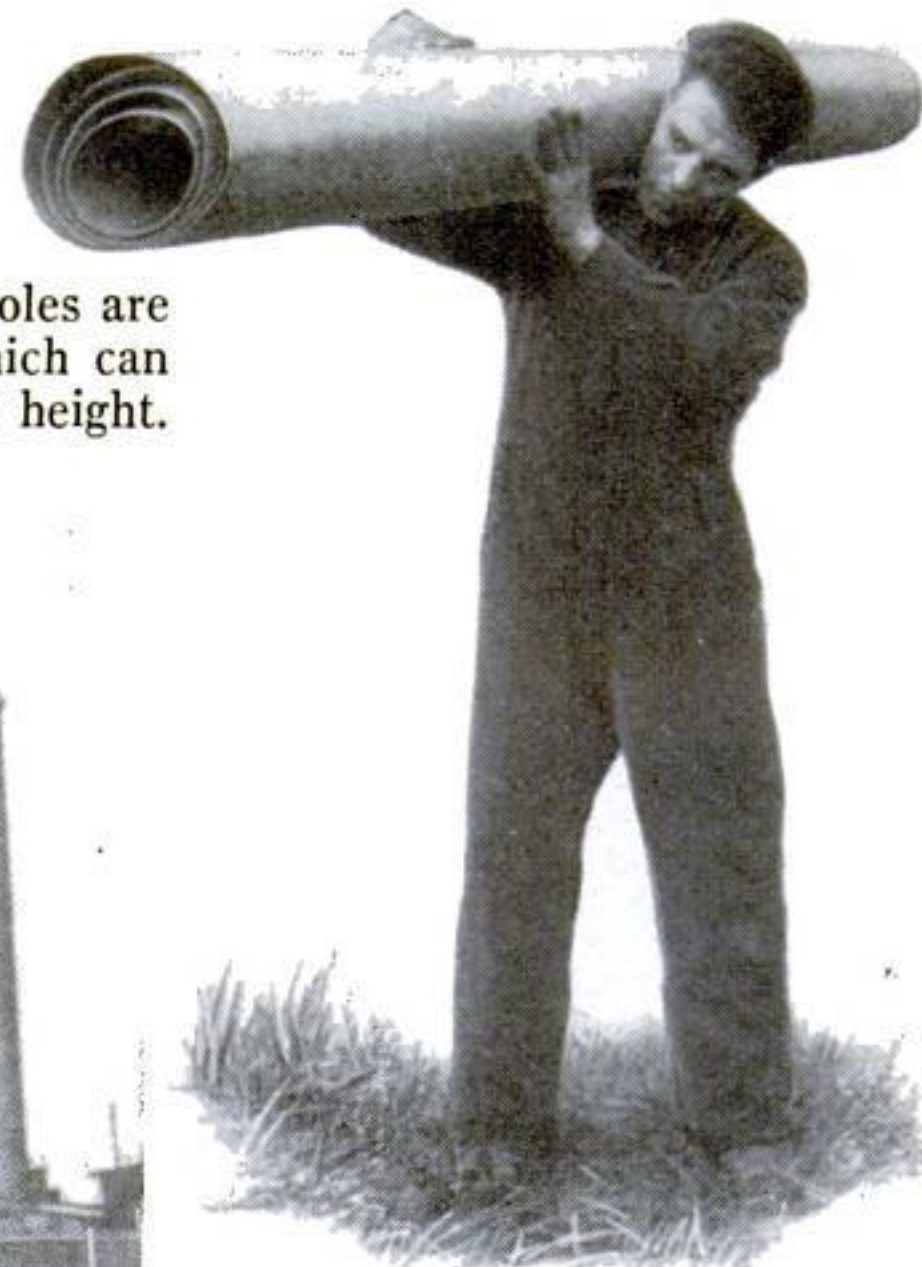


MOUSE SINGS ON RADIO

BILLED as the singing mouse, Minnie, a pet at an Illinois children's home, recently broadcast her musical squeaking from a Chicago, radio station. The gifted rodent, whose ability to make voicelike sounds has interested zoölogists, was placed in a glass cage with the studio microphone suspended above its perforated top.

TELEPHONE POLES TELESCOPE

WEIGHING less than one third as much as conventional wooden types, new telescoping poles for telegraph, power, and telephone lines are made of lightweight steel. Elliptical in shape, the poles are made in standard sections of varying diameter which can be jointed together to form shafts of any desired height.



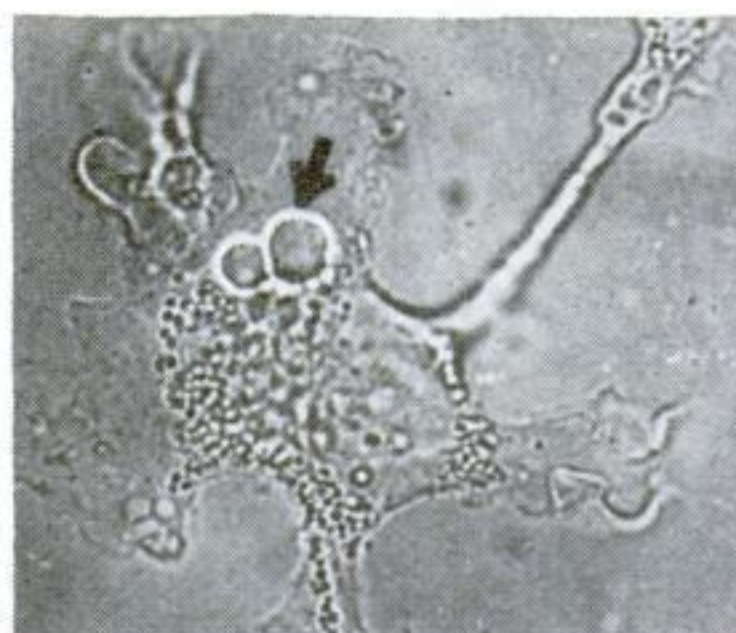
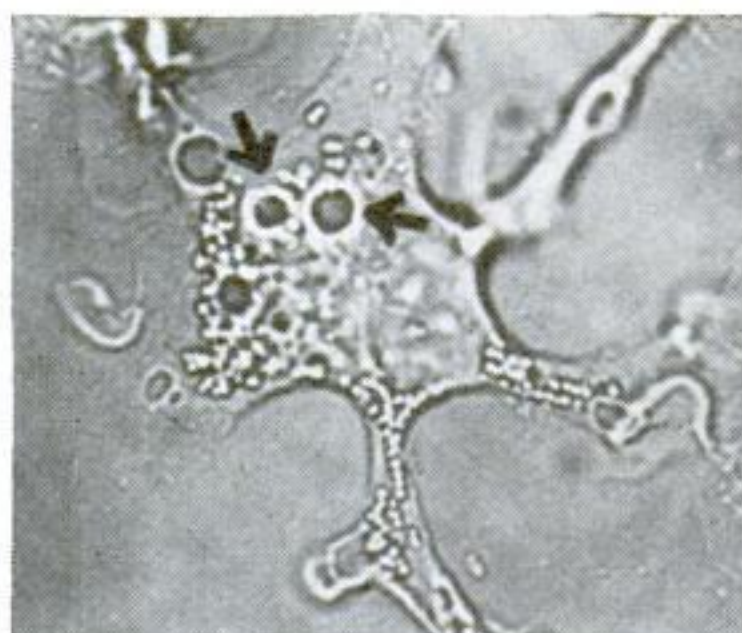
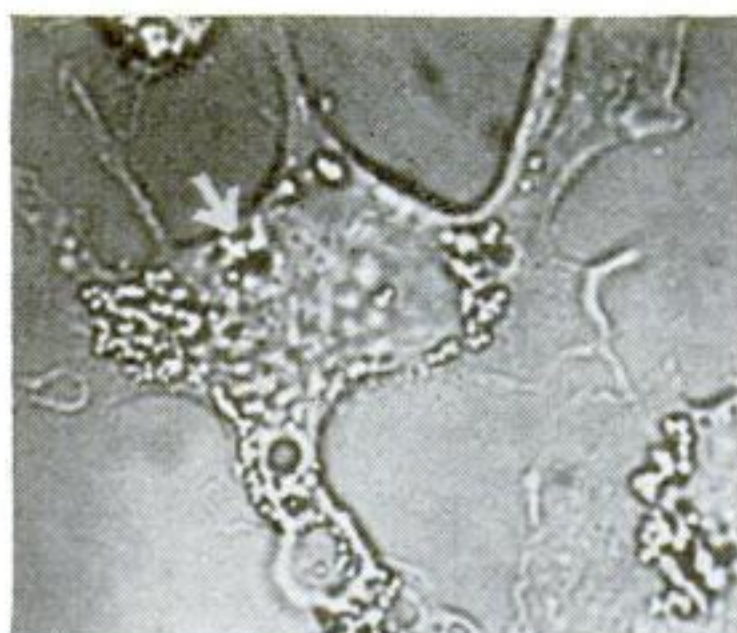
Sections of telescoping metal pole nested for carrying and, left, being raised by one man

MOVIES SHOW HOW CELLS IN BLOOD REMOVE DEAD TISSUE

MAGNIFIED more than 1,000 times, stills taken from slow-motion moving pictures made by Dr. Warren H. Lewis of the Carnegie Institution, Washington,

D. C., show how the white cells in human blood swallow up and destroy pieces of dead tissue in the blood stream. Living in a free state, the macrophage cells rush

to any bruised or diseased spot to attack and destroy bacteria, waste, or damaged tissue, by the process of digestion shown in the series of photographs below.

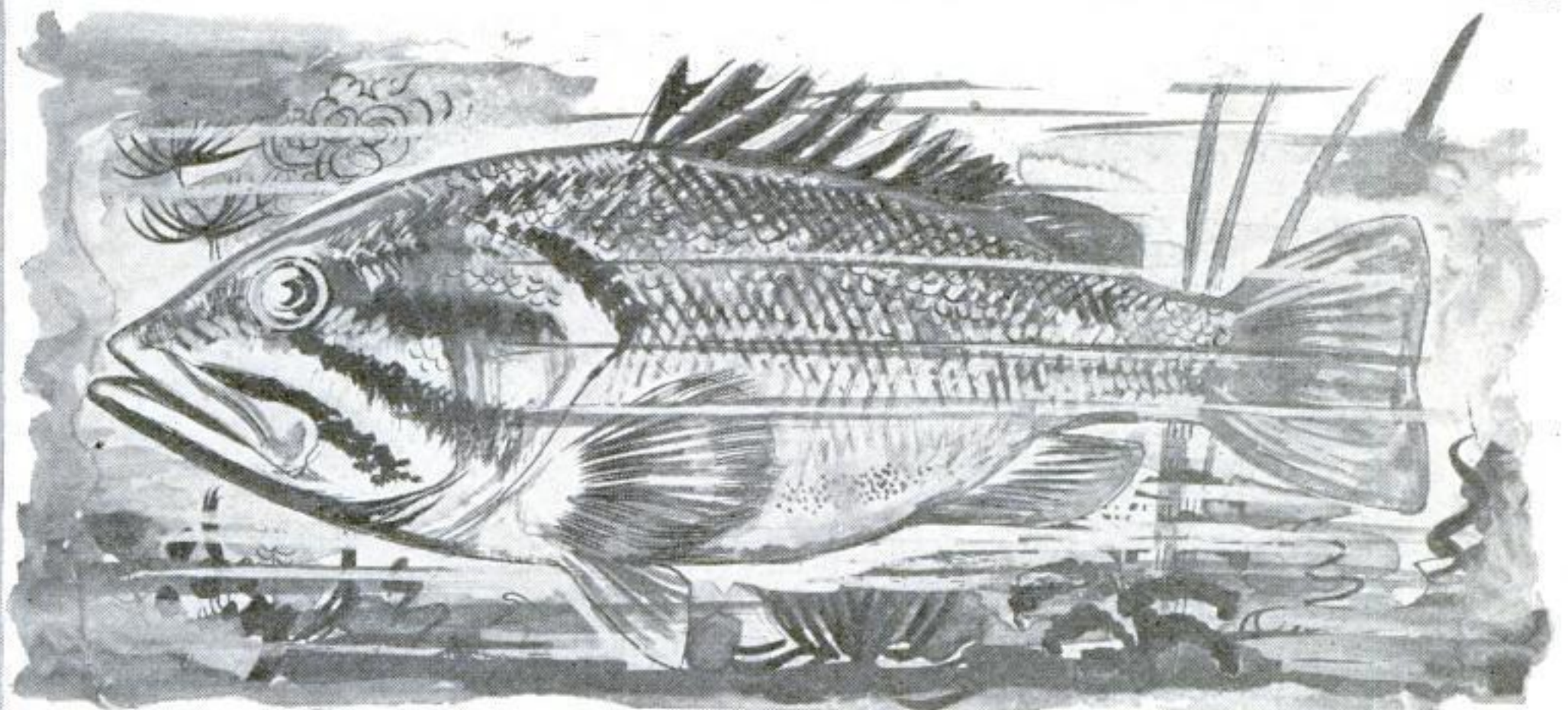


- 1 A white blood cell about to attack two pieces of dead tissue
- 2 Two minutes later: It has taken the dead cells within its walls
- 3 Twelve minutes later: The waste cells are much reduced in size
- 4 Eighteen minutes later: The two dead cells have been digested

Un-Natural History

SWINGING IN GREAT CIRCLES IN THE GLARING SUNLIGHT OF THE UPPER AIR, THE **EAGLE** NEEDS AN EYE SHIELD. SO NATURE HAS EQUIPPED HIM WITH A HEAVY, OVERHANGING BROW TO SHIELD HIS POWERFUL EYES FROM THE SUN!

AND, SPEAKING OF EYES--THE EAGLE, LIKE ALL OTHER BIRDS, HAS A TRANSPARENT **THIRD LID** FOR EACH EYE. WORKING LIKE A CAMERA SHUTTER, IT KEEPS THE EYE CLEAR OF DUST MOTES AND OTHER FOREIGN PARTICLES



FISH, ON THE OTHER HAND, DO NOT NEED EYEBROWS OR EYELIDS, EITHER TRANSPARENT OR OPAQUE! WHERE THEY LIVE, THERE IS NO GLARING LIGHT, AND THE TRANSPARENT CUSHION OF WATER GUARDS THEIR EYES FROM DIRT AND INJURY

By
**GUS
MAGER**

SUBMARINE PERISCOPES ARE OLD STUFF TO THE **FROG**! HIS EYES ARE SET IN BUMPS THAT STICK OUT OF THE TOP OF HIS HEAD, SO THAT HE CAN KEEP HIS BODY HIDDEN UNDER WATER WHILE WATCHING FOR FOOD OR DANGER!



THE **SNAKE**, TOO, HAS A TRANSPARENT EYE SHIELD--A CLEAR, HORNY WINDOWPANE THAT PROTECTS ITS EYES FROM BRIERS AND DIRT AS IT CRAWLS OVER THE GROUND. IT SHEDS THIS EYE PLATE WITH ITS SKIN!



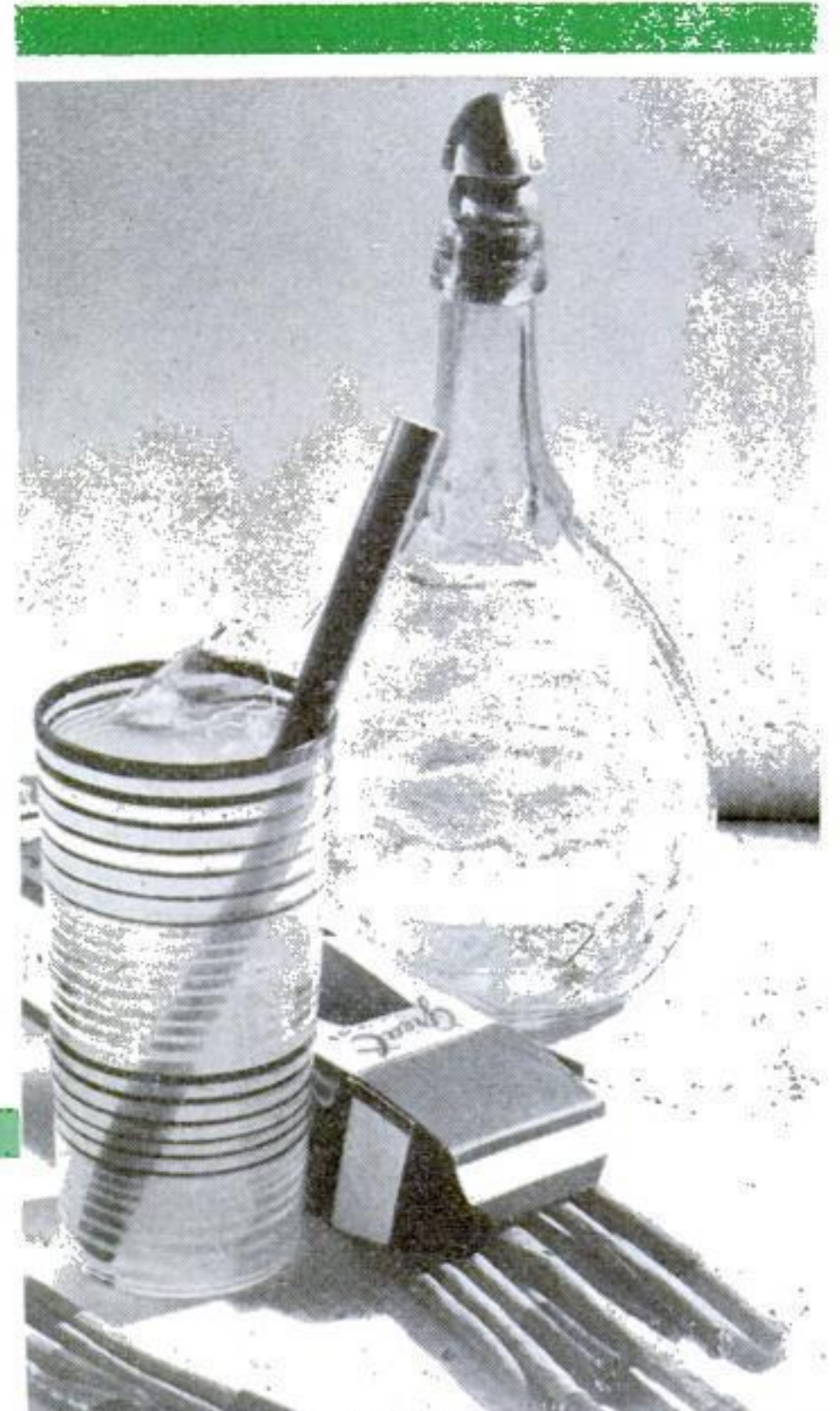
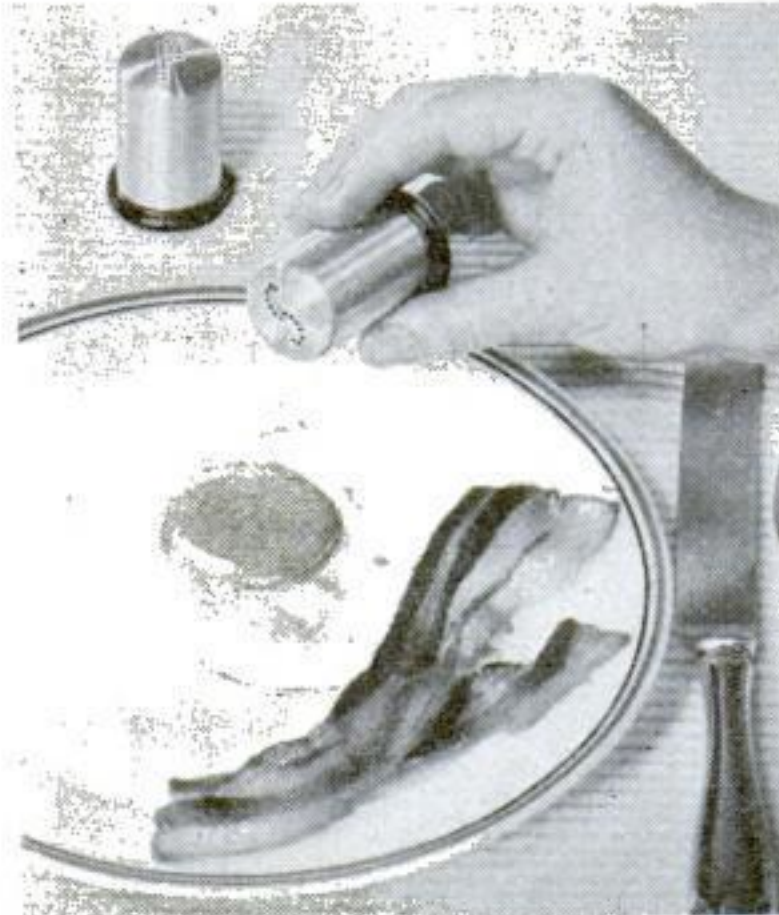
WHAT MAKES A **FLY** SO HARD TO HIT IS THE FACT THAT HE HAS AN ALL-SEEING EYE! ON EITHER SIDE OF HIS HEAD IS A CLUSTER CONTAINING THOUSANDS OF EYES, EACH FOCUSED IN A DIFFERENT DIRECTION! THE **DRAGON FLY** HAS A BATTERY OF 13,000 EYES!

Latest Inventions FOR THE HOUSEHOLD



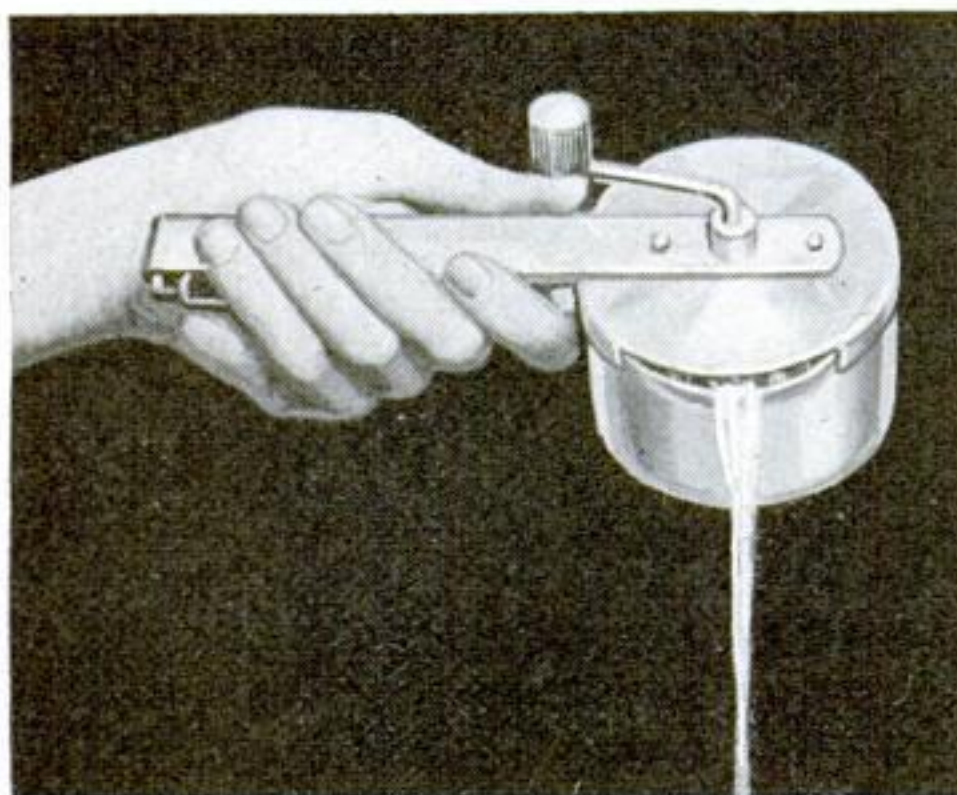
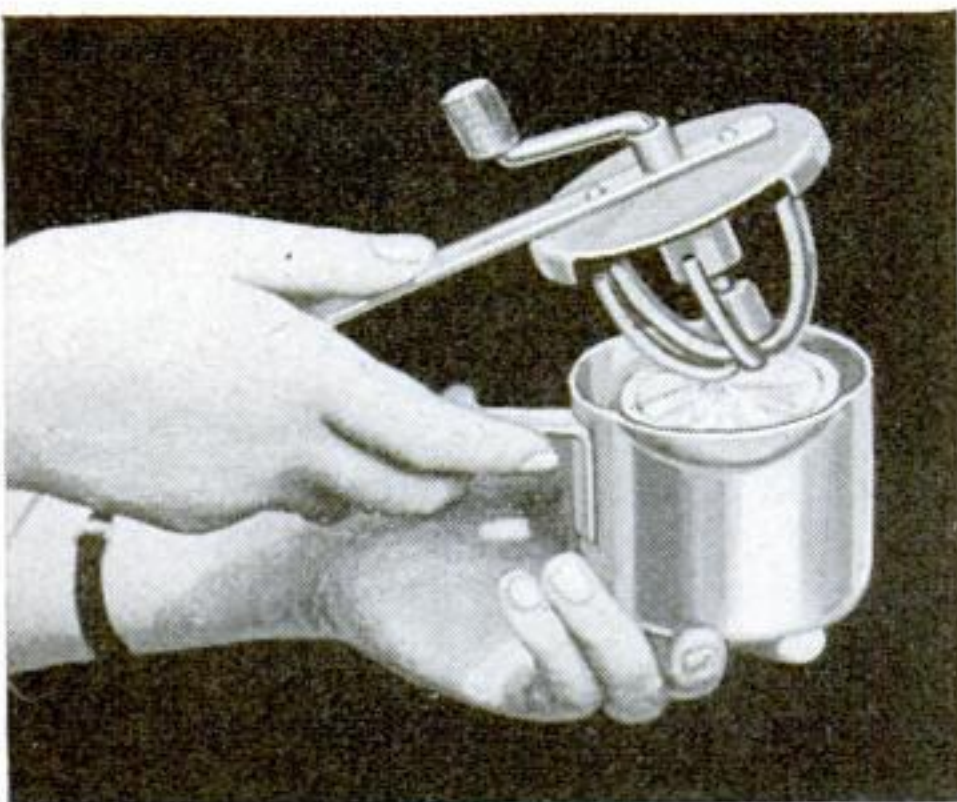
REFRIGERATOR FOOD SAVER. A set of three food containers that fit in a sliding tray is a handy feature of a new refrigerator. The arrangement makes it possible to keep left-overs in a minimum of space. Another compartment holds fruits and vegetables

FOOLPROOF SHAKERS. No danger of mistaking pepper for salt with these new shakers made of aluminum with bases of a plastic material. The perforations in the top of the salt shaker form an "S" and those on the pepper a "P"



CINNAMON MIXING STICKS. Used instead of the familiar glass rods, selected sticks of cinnamon give added flavor to drinks stirred with them. They are said to last for a surprisingly long time

MILK-BOTTLE COVER. Placed over a bottle of milk at the time of delivery, the insulated cover shown at the right locks around the bottle and protects it from animals, dirt, and extreme cold or heat. Pressing a handy lever releases the bottle



FRUIT-JUICE EXTRACTOR. When a half lemon or orange is placed in the rounded bowl of this device, the spring handle is squeezed to press the wire reamer against the fruit. Turning the handle extracts the juice, which is poured out by tilting the bowl as shown



SERVES SIRUP WITHOUT MESS

Sirup, catchup, honey, and similar liquids are served neatly with the dispenser pictured at the right. When a lever is pressed, the liquid comes out at the bottom. After using, the bowl is put in the receptacle also shown

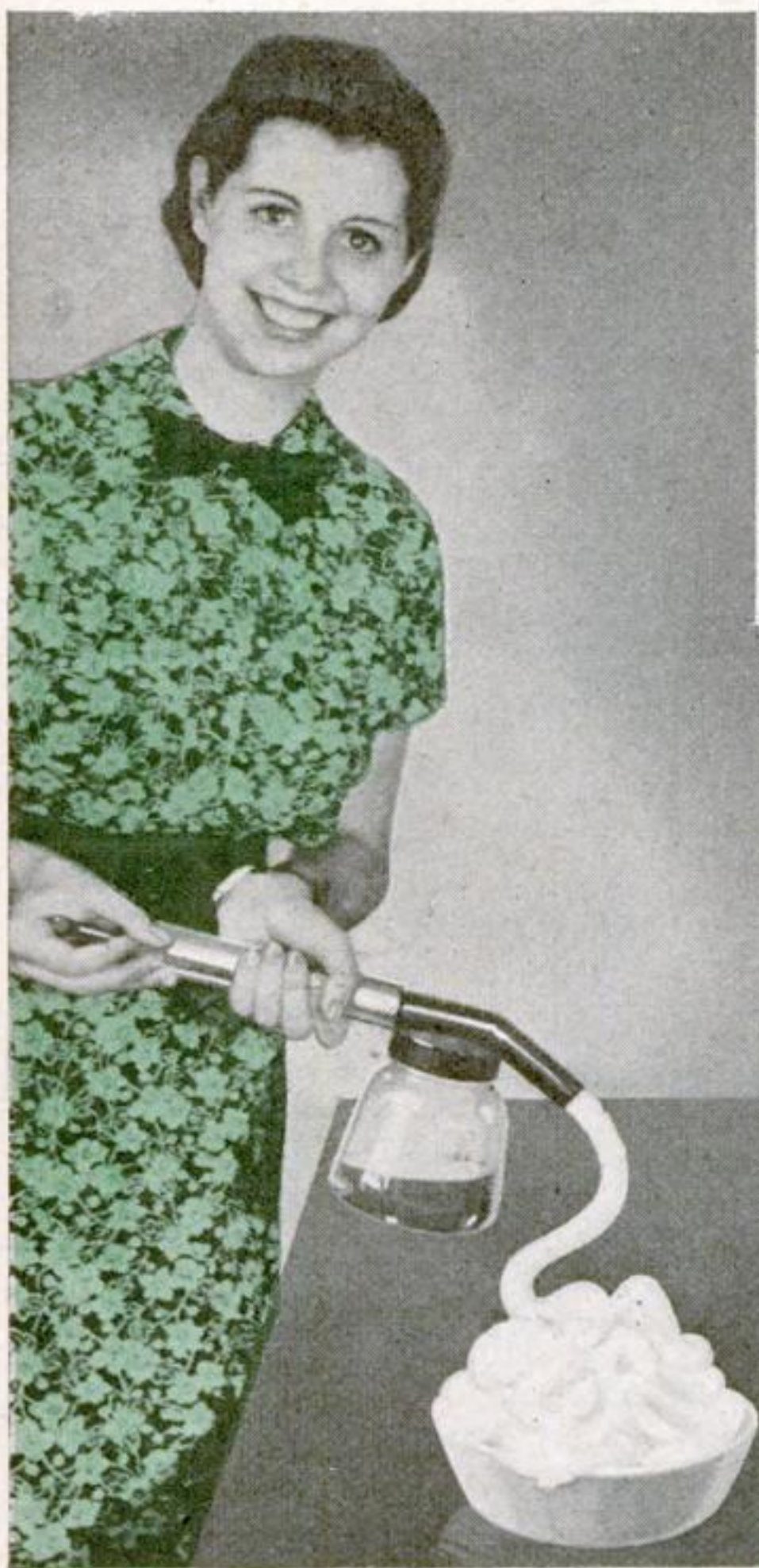


EXTENSION TABLE OUTLET

A handy outlet for electrical table appliances is provided by the portable stand seen at the right. Several wires can be connected to it without tangling. It also is specially useful for ironing

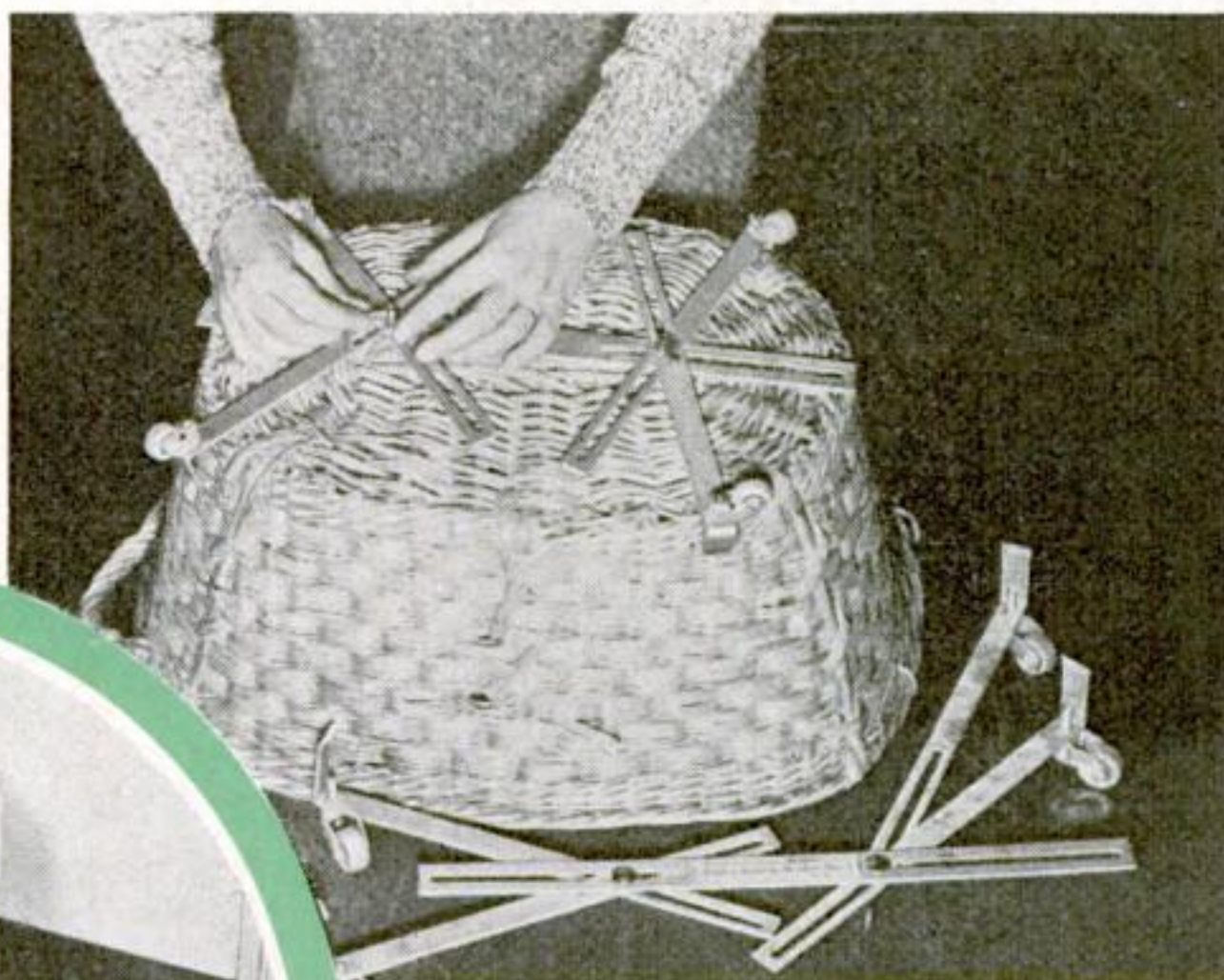


MAKES FOAM FOR CLEANING. With the appliance illustrated below, a stiff, lathery, "dry" foam is produced for cleaning woodwork, upholstery, carpets, and many other things. A special fluid is put into the jar and a hand pump works up the lather, which is forced out at the nozzle



BASKET CASTERS

Baskets used to hold laundry and similar heavy loads can be fitted with casters by means of a device pictured at the right. An adjustable frame, clamped to the bottom of the basket, bears four sturdy casters



LAMP HAS OUTLET IN BASE

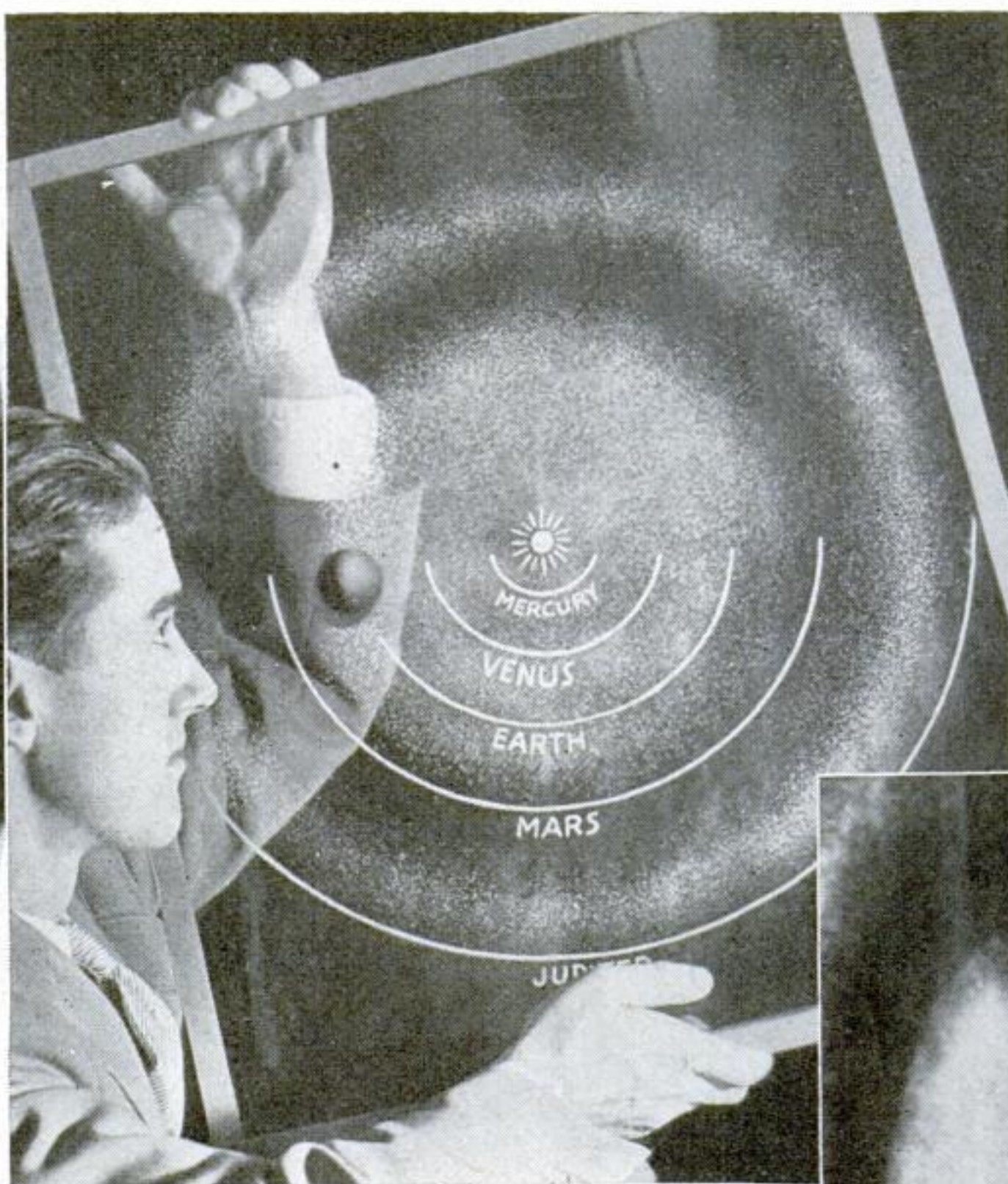
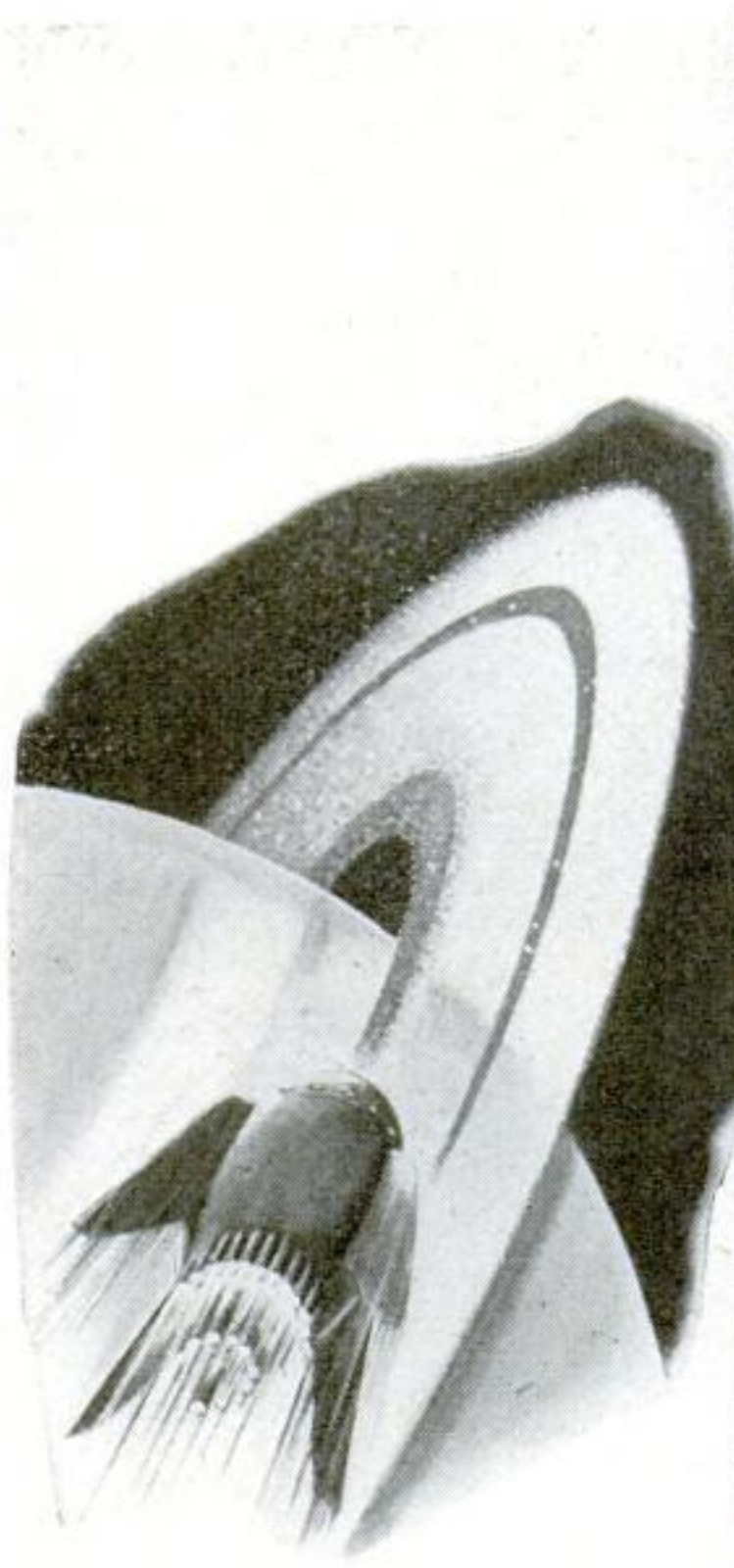
An outlet in the base of the table lamp below provides a handy place to plug in a table radio, curling iron, vacuum cleaner, or other electrical appliance. The outlet does not mar the lamp's appearance



DEEP-WELL ELECTRIC COOKER

Supplied as part of the equipment of a new electric range, this portable cooker can be used to prepare a complete meal anywhere that power is available. When not in use, it is kept in a drawer of the range, as illustrated above





IS OUR SUN SURROUNDED BY A DUST RING LIKE SATURN'S?

The most common theory to account for the weird glow seen in the plane of the ecliptic is that the sun has a disk of meteoric particles like the "rings" of Saturn, shown at extreme left as they would appear from an imaginary rocket ship. By spattering a pane of glass with paint and sighting across a miniature earth, as illustrated, you can see a replica of the "zodiacal light" as in the inset. Above, the light itself as seen from a ship at sea



Ghost Lights *in the Sky*

... EASY EXPERIMENTS DEMONSTRATE 'ZODIACAL LIGHT' and 'COUNTERGLOW'

IF YOU could fly in an interplanetary rocket to Saturn you would see a remarkable spectacle as your craft approached the "ringed planet" of our solar system. The gigantic ring of meteoric particles encircling the planet, seen from its edge, would loom high into the sky, and, as you came within 50,000 miles or so, would become a great wedge of light extending up from Saturn's horizon. The wedge of light would be, of course, one end of a long oval, formed by Saturn's ring, when seen in sharp perspective.

If, as many astronomers believe, our sun also is surrounded by an enormous flat ring of meteoric dust, with the earth near its edge, we might expect to see a similar oval wedge in our sky after dark or before sunrise—as we look across one side of the ring. And, as a matter of fact, this is exactly what we do see, if we look for it! This luminous wedge is called the "zodiacal light," and its appearance in the earth's sky is shown in one of the illustrations.

A simple experiment will explain the ring's shape, as seen from the earth, still more clearly.

To represent the ring, or disk, of dust lying in the ecliptic plane around the sun, I spattered some white water-color paint upon a large pane of window glass. When I held this pane (representing the plane of the earth's orbit around the sun) edge-wise, and looked across the ring of paint in perspective and across a small ball glued to the glass to represent the earth, an arc of the ring became wedge-shaped

and strongly resembled the zodiacal light cone seen on the earth's horizon after dark. The small inset in the photograph illustrating this experiment was taken across the ring of paint on the pane of glass, and forms an interesting comparison with the ring of Saturn and the zodiacal light.

If you have never observed the zodiacal light, you must know both where to look and when to look, for it is not always visible as plainly in north temperate latitudes as it is in the tropics.

In lands near the equator, where the sun's path rises at a very high angle with the horizon, the oval cone of light streams up clear of the horizon's haze every night, and is plainly visible after dark. But in the latitude of New York, where the ecliptic often is at a low angle, even a thin layer of mist will hide the glow. Accordingly, you must look for the faint, luminous wedge in the western sky after sunset from February to April, and in the eastern sky before dawn from August to October, when the sun rises at a greater slant to the horizon.

If the night is very clear, and the moon absent, you may see both the eastern and western wedges at once, with their

tips connected clear across the sky by a faint band of light, six or eight times the width of the moon. Under these conditions you will probably also see the "counter glow" as an oval enlargement of the band, something like the gem on a ring.

The counter glow, or "Gegenschein," is usually round or oval and varies in size. It is a very faint nebulous patch, so faint that even near-by bright stars or planets can make it become entirely invisible.

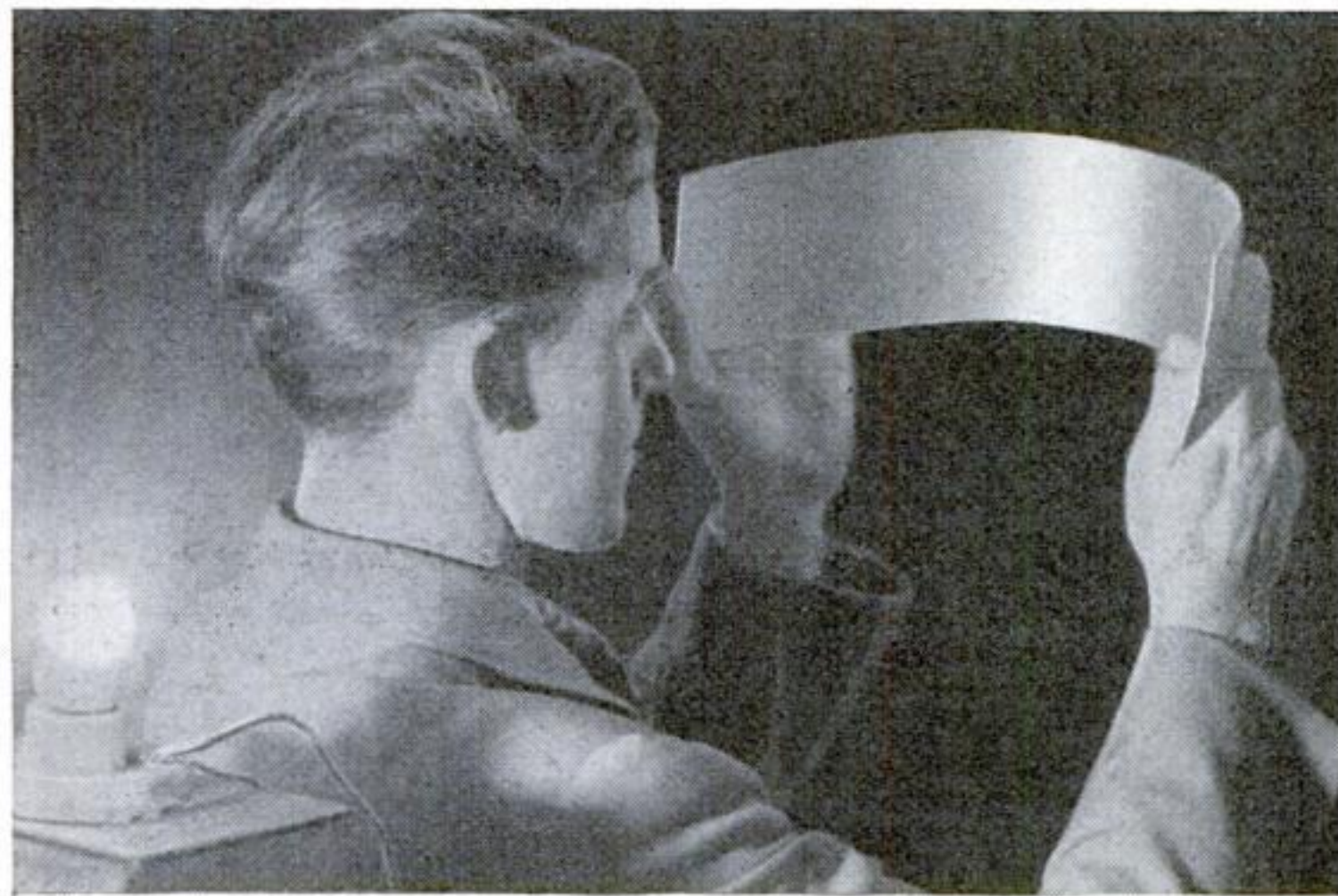
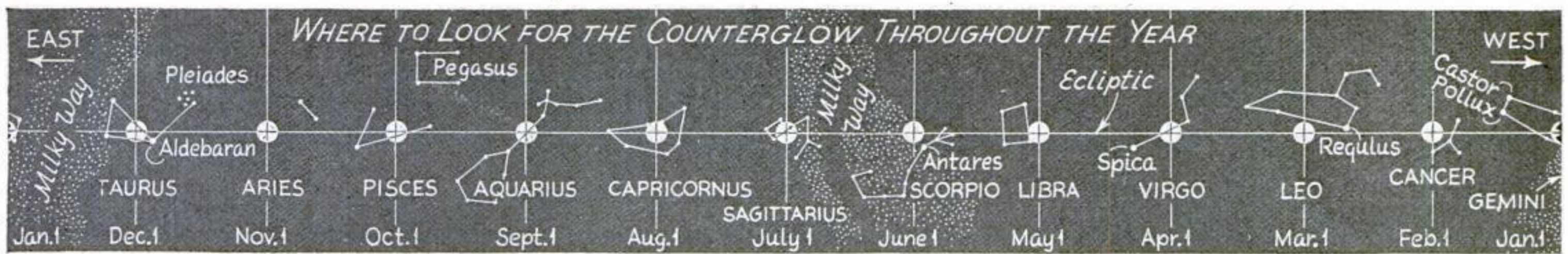
The counter glow is so named because it is always exactly "counter," or opposite, to the sun. Accordingly, it goes the round of the zodiacal constellations once every year. In the latitude of New York, it is best seen in September and October, when its ghostly shape appears in the constellations of Aquarius and Pisces. It can never be seen in June or December, because it is then crossing the Milky Way, whose light drowns it completely.

This strange ghost of the sky has been explained by several theories, two of which can be illustrated by simple experiments with everyday materials.

The first requires only a strip of tin or silvered cardboard. If you stand with your back squarely to an unshaded lamp bulb, as shown in one of the photographs, and bend the strip of shiny metal or cardboard into an arc, you will see the reflection of the lamp very strongly at the spot that is directly in front of you and in

By

Gaylord Johnson



This chart of the zodiac gives the place of the counter glow at various times in the year. To illustrate this faint patch of light seen in the sky on the opposite side of the earth from the sun, hold a strip of shiny tin or silver paper curved as seen at the left, with a light behind your head. The surface of the metal will reflect the light like the supposed ring of meteoric particles outside the earth's orbit. At right is the actual counter glow



line with both your eye and the lamp. This experiment shows how the light of the sun is thought to be reflected from a ring of meteoric dust lying between the orbits of Mars and Jupiter, thus forming the counter glow. The bent silver paper or tin strip represents part of the ring of meteors, and the luminous reflections opposite the lamp, the counter glow opposite the sun.

The same astronomers who believe that the zodiacal light is caused by the sun's light reflected from a giant disk of meteors within the earth's orbit, think that the counter glow is produced by light reflected back from a ring of meteoric dust far outside of its path.

Some interesting calculations recently made by astronomers at Mount Wilson, in California, show what a surprisingly small number of meteoric particles would be necessary to produce the ghostly spectre of the zodiacal light. The phenomenon would be accounted for if, inside the earth's orbit, there were particles only one millimeter in diameter, at an average distance of about five miles apart!

This all sounds very convincing, but there is another entirely different theory to be considered. It was advanced by the late Prof. E. E. Barnard, one of the foremost authorities in modern astronomy.

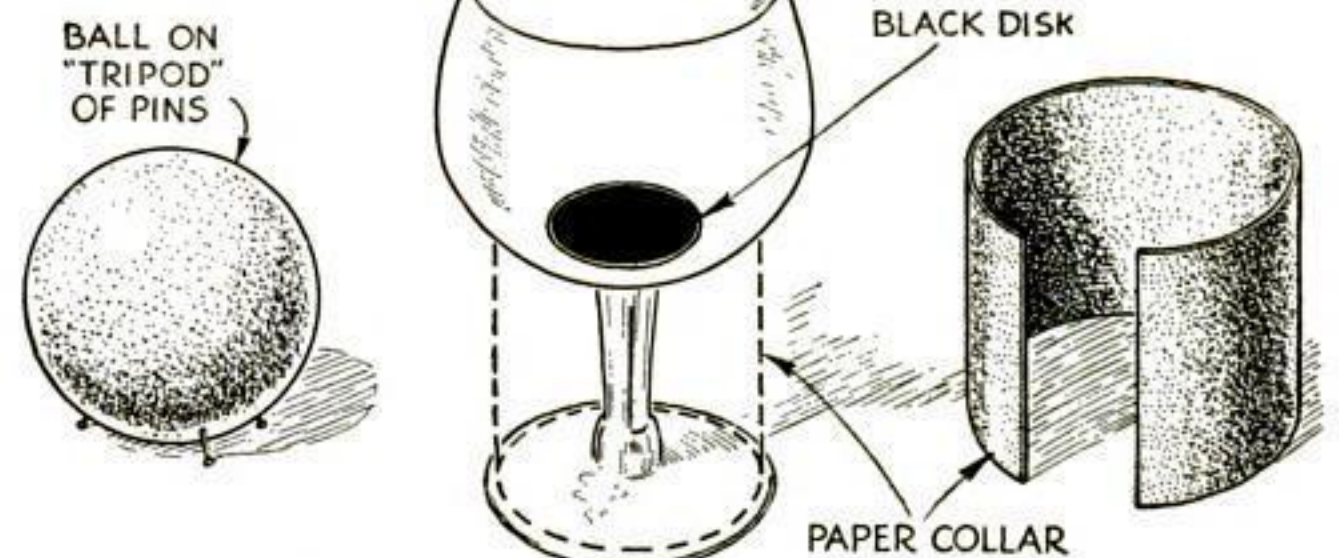
Professor Barnard denied the theory of meteoric rings entirely. Instead, he contended that the zodiacal light, counter glow, and zodiacal bands are all produced by simple extension of twilight. The sun's rays, he explained, are merely bent through the atmosphere on the dark half of our globe.

At the point exactly opposite the sun, the rays of diffused light, meeting from all directions, produce the brighter area called the counter glow, in the same way that the beams of two flash lights, crossing, produce a more luminous spot where their rays join.

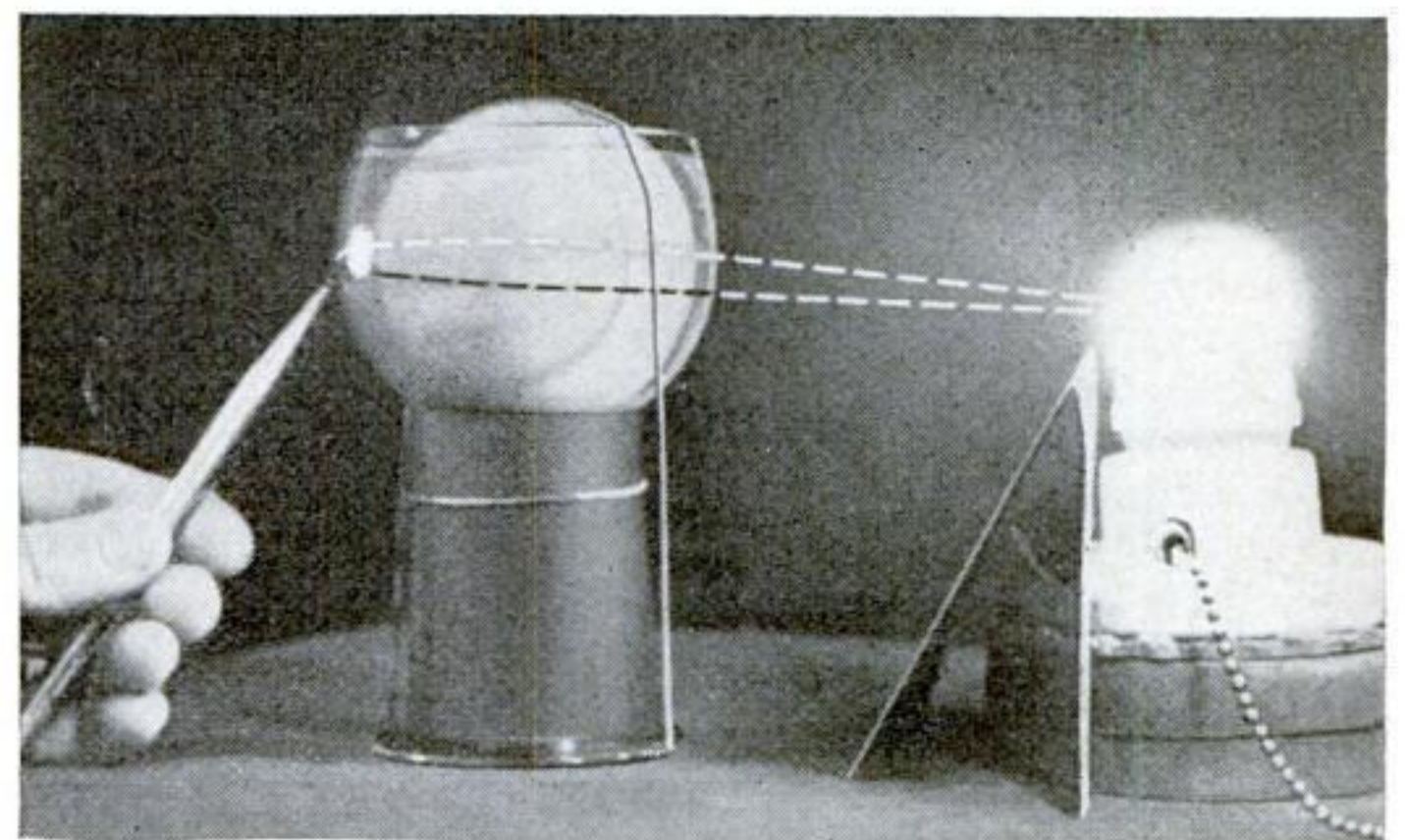
When I tried to think of simple materials for testing and illustrating Barnard's theory, I hit upon a spherical beer glass and a rubber ball about a half inch

smaller in diameter. To cut off reflected light from the stem and base, I stuck a disk of blackened adhesive tape inside the bottom of the glass and wound a band of black paper around the stem. Three pins, stuck into the ball like the legs of a tripod, supported it inside the glass so that a quarter-inch space was left all around, and this space was filled with water. A rubber band stretched under the base of the glass and over the top held the ball down in the water, creating a satisfactory working model of the earth with its surrounding film of atmosphere.

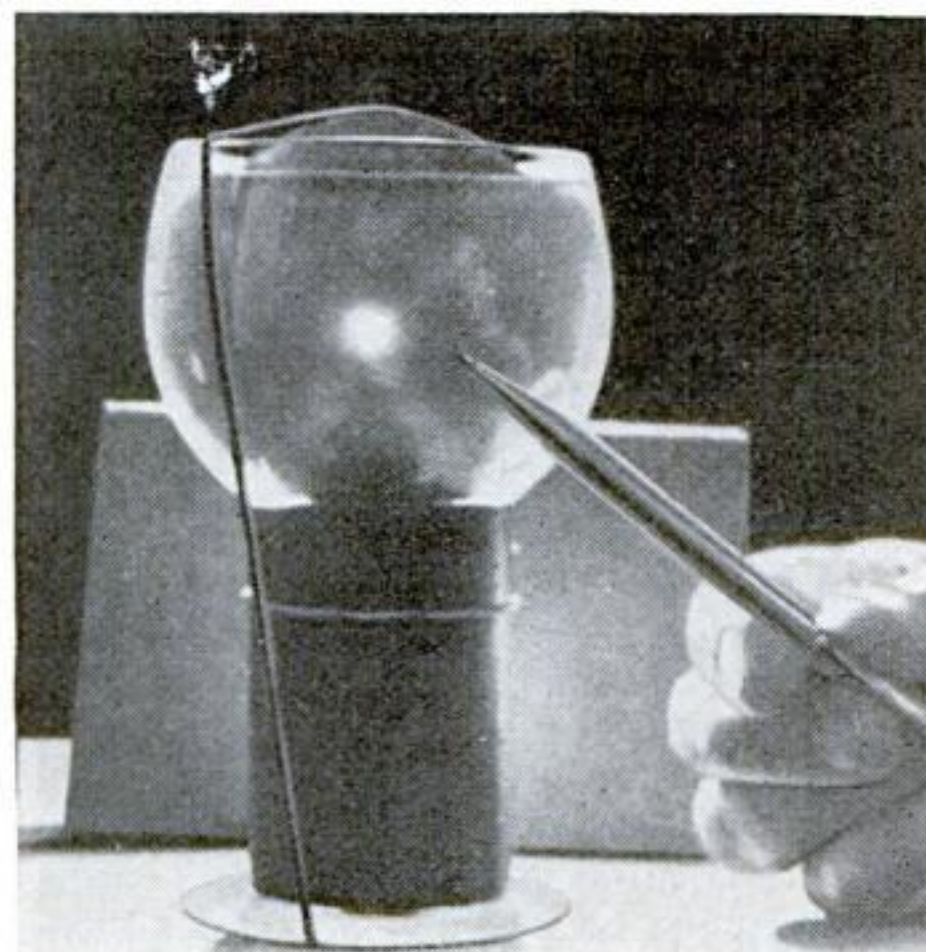
When this model was interposed between my eye and a



With a beer glass and a rubber ball, you can demonstrate another theory of the counter glow. A sleeve of black paper and a disk of blackened adhesive tape suppress unwanted reflections



The ball is supported inside the glass and surrounded by a layer of water to represent the film of atmosphere that surrounds the earth



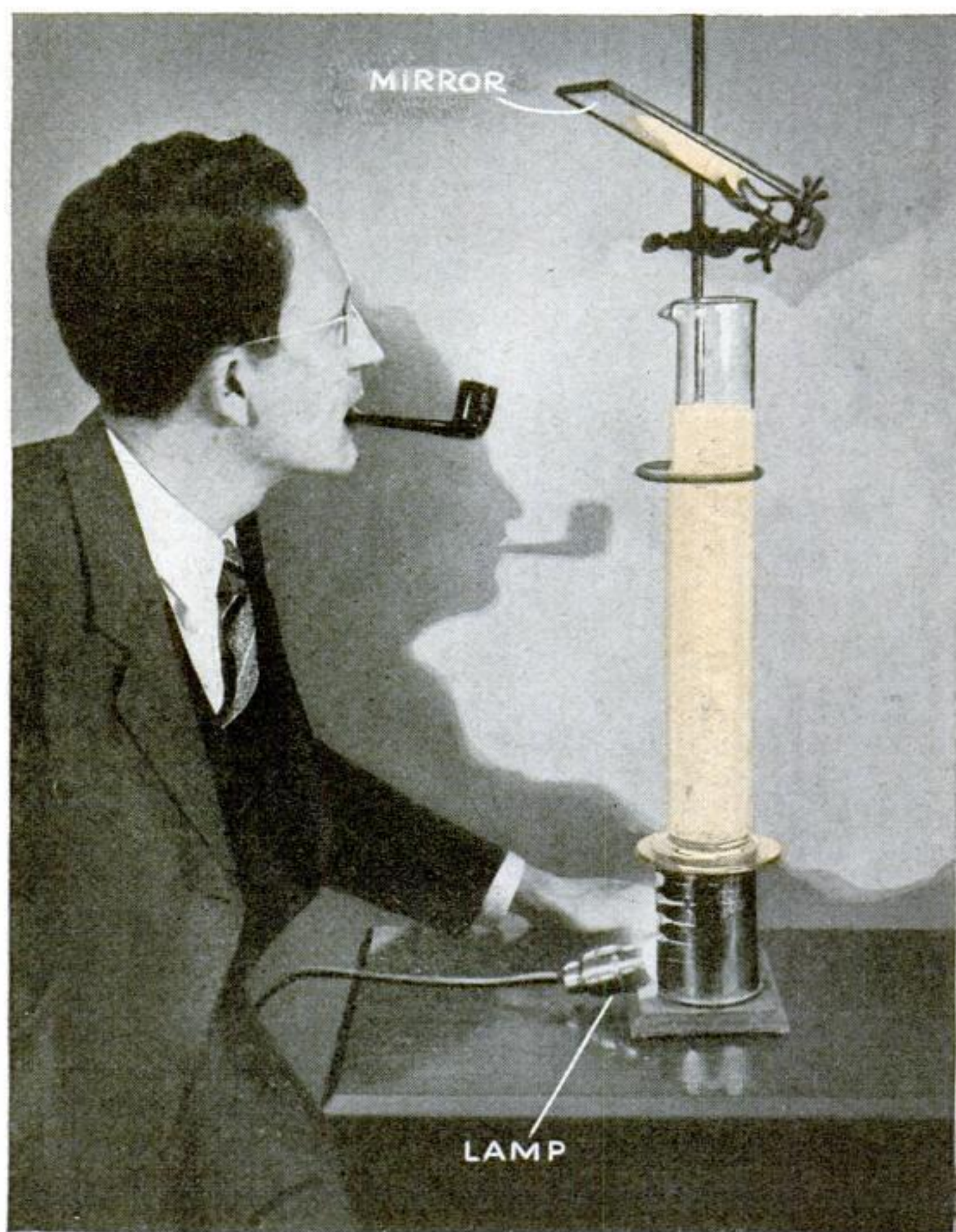
The rays of a lamp are bent around the ball and focused at a point on the opposite side, simulating the supposed action of sunlight

small seven-watt frosted electric-light bulb representing the sun, I was surprised and delighted to see that a counter glow was actually produced on the side of the ball exactly opposite the bulb. You can see it for yourself by performing the experiment.

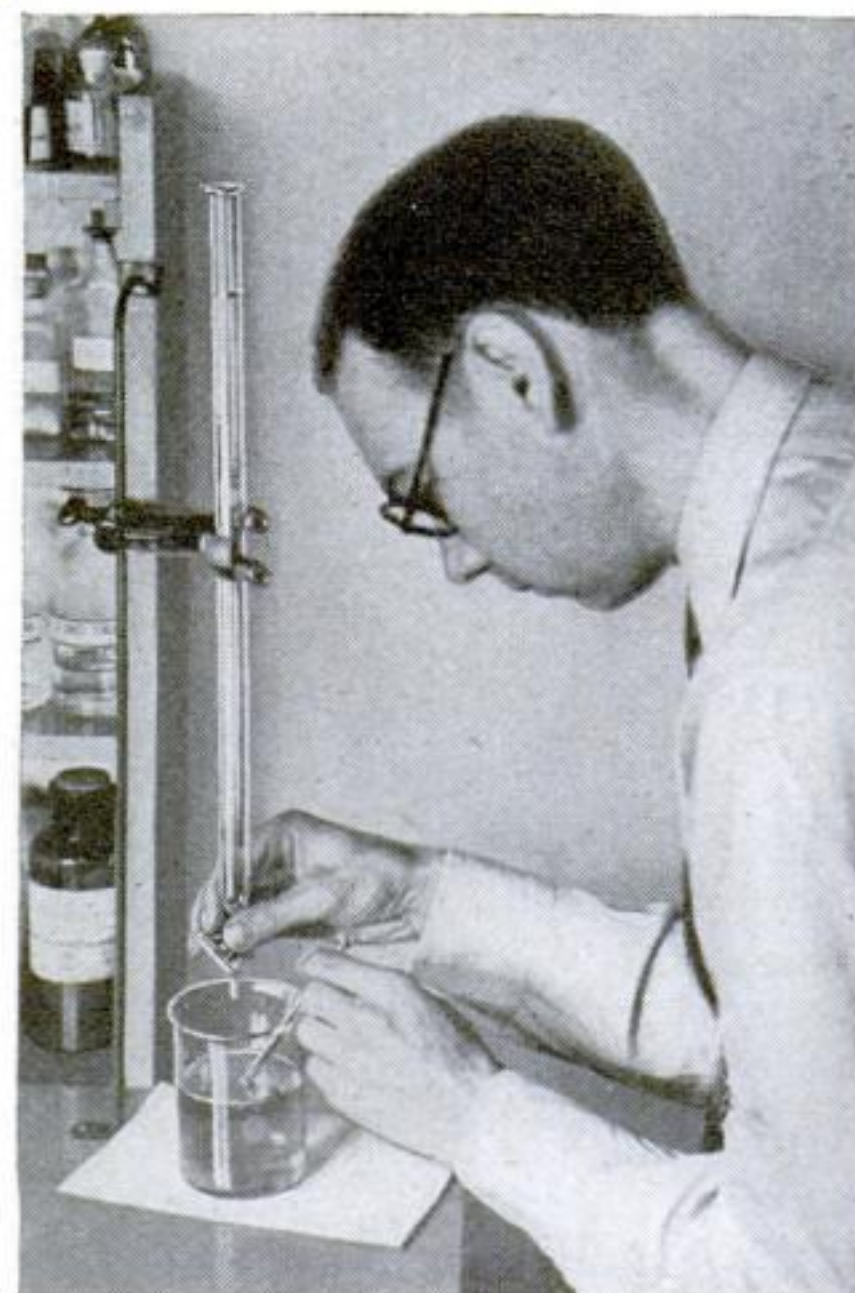
These two opposing opinions about the zodiacal light and the counter glow furnish an example of the way in which the same phenomena can be accounted for by entirely different theories. Nearly all the popular textbooks on astronomy accept the ring-of-dust theory, yet the principle applied in Barnard's view can be demonstrated with equipment as simple as a beer glass and a rubber ball!

Colorful Experiments

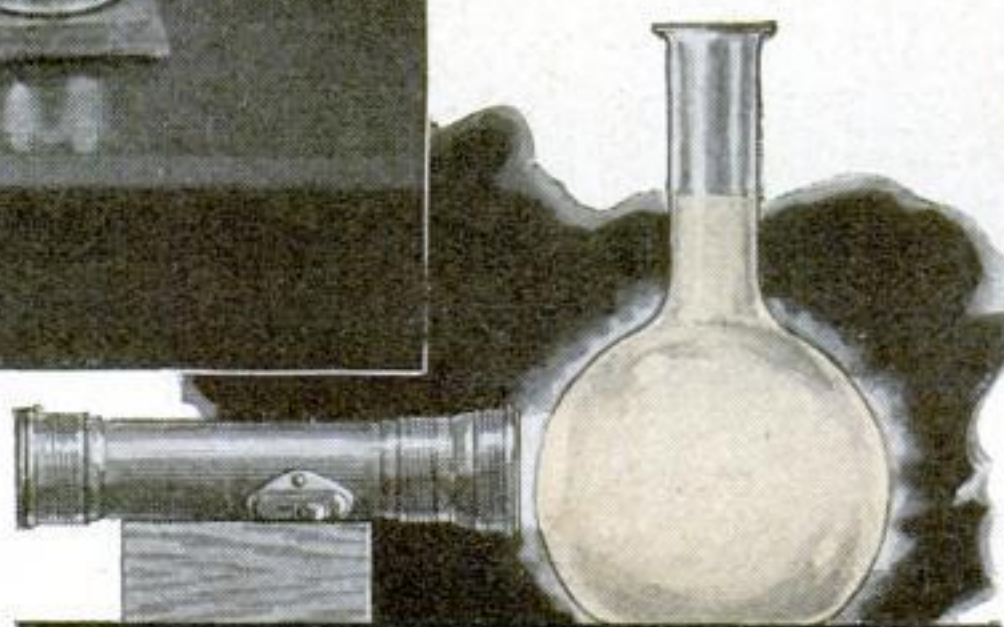
SHOW HOW CHEMICALS CAN BE TESTED



In the striking experiment illustrated at the left, the refraction of light by finely divided particles suspended in a liquid gives the effect first of a clear sky, then of a yellow dusk, and finally of red sunset. An electric bulb in the can under the cylinder throws light upward through the liquid, to be reflected by a tilted mirror. The drawing below shows a simpler arrangement



A typical "titration" test, in which a change of color indicates when enough of a chemical solution has been added to produce an effect



TINTS that rival the rainbow, and mystifying changes of hue, are easy to produce in your home laboratory. Among the compounds of manganese, iron, copper, and chromium on your laboratory shelf, you will find ample material to yield a fascinating variety of shades. Not only are experiments with colors pretty to look at, but in many cases they have real practical value in testing household and chemical preparations.

You might not think of manganese as a colorful substance, from the dull appearance of one of its compounds, manganese dioxide. But try mixing some of the black powder with sodium hydroxide—or ordinary lye—and a few crystals of sodium nitrate or potassium nitrate. Heat the mixture in a tin-can lid to as high a temperature as possible. The chemical reaction that takes place between these colorless materials produces sodium manganate or potassium manganate. Dissolve some of this residue in water, and the solution will be green.

Now, merely by blowing your breath into this solution through a tube of glass or rubber, you can produce a surprising change in its color. It first turns red, and then violet. The carbon dioxide in the air you exhaled transformed the green manganate into a purple permanganate.

Another interesting color effect occurs in a simple test that you can apply to detect the presence of iron in medicinal

tonics, raisins, or soil. First heat the substance to be tested in a porcelain evaporating dish, until all the combustible part of the sample has been burned away. When the residue has cooled, add several drops of nitric acid. Heat the paste very gently. Dilute the contents of the vessel with water and continue heating, to dissolve the iron that has been left behind as iron oxide in the first heating operation.

Now place a drop of the resulting iron solution in a test tube and add a few drops of a solution of ammonium thiocyanate (also called ammonium sulphocyanide). The liquid takes on a beautiful red color, which is due to the formation of iron thiocyanate. If you do not know whether a substance contains iron, and the red color appears when you perform this test, then it is extremely likely that iron is present.

This experiment can be reversed—that is, you can make the reaction run backward and cause the red color to fade. Put about a quart of water in each of two containers; milk bottles, vases of clear glass, or regular chemical graduates will serve. In one, dissolve about half a gram, or a crystal half the size of a pea, of ferric chloride. An equal quantity of ammonium thiocyanate should be dissolved in the other. Mix the solutions, and the red color of iron thiocyanate appears.

Now add several cubic centimeters—a teaspoonful or so—of strong ammonium chloride solution, and you will see the color grow paler. It will not disappear entirely, but it fades enough to demonstrate the important fact that a chemical reaction may be reversible.

The color-producing reaction could be summed up, "ferric chloride plus ammonium thiocyanate produces iron thiocyanate plus ammonium chloride," and the decolorizing reaction is described simply by reading the other way. The same chemicals are present, all the time. They tend to interact with each other in every possible fashion. There is nothing mysterious about what makes the color deepen in one case and fade in the other. Which way the reaction goes, as a whole, depends upon the preponderance, or relatively high concentration, of one or another of the various chemicals involved. Adding an excess of any one of them swings the balance toward the opposite direction. On the other hand, a reaction is not reversible when one of the products escapes completely from the rest—as a precipitate or a gas, for example—and so this type always goes in the same direction. Whole volumes of chemistry are compressed in these simple laws; they go a long way toward explaining why all chemical reactions happen.

While you have the red-colored iron thiocyanate solution, pour some of it into a flask, add a little ether, and shake the mixture. When you stop agitating the liquid you will find the color concentrated in the layer of ether. You can exhibit the experiment as a feat of chemical magic that extracts the "essence of color" from the red fluid.

Interesting color changes may be produced in the familiar blue solution that you obtain when you dissolve crystals of copper sulphate in water. Add a few drops of household ammonia to the solution, and a light-blue precipitate of copper hydroxide appears. When you add more ammonia, stirring the liquid meanwhile, the precipitate redissolves and the solution takes on a deep, intense, azure-blue color. The appearance of this hue, when ammonia is added to a solution of unknown ingredients, serves as a test for copper. Enough ammonia should be used to produce a strong odor from the fluid. The tint is distinct from the blue color of copper sulphate solution, and is produced by the chemical combination of the copper and ammonia.

The blue tint of solid copper sulphate crystals may prove impermanent. Those in your reagent bottle may have developed white spots. However, that does not mean that they are spoiled or unfit for use in experiments. It simply shows that they have lost some of their "water of crystallization," the moisture normally imprisoned in the crystals. Touch the whitish spots with a drop of water or expose the crystals to humid air, and their natural color is restored.

You can drive off the water of crystallization artificially and turn copper sul-

By Raymond B. Wailes

phate crystals into dry or "anhydrous" copper sulphate by heating them in a test tube, a crucible, or the lid of a tin can. A white powder results, which can be turned blue by adding a drop of water. This affords a test for the "absolute" or water-free alcohol used in some types of laboratory work. If a preparation labeled "absolute alcohol" turns the white powder blue, then it is contaminated with water.

If you have cupric chloride, another copper salt, in your laboratory, try dissolving some crystals in a very small amount of water. The resulting solution will be yellow. Add just a little more water, and it becomes green, while further dilution turns it blue. Similar color changes occur when cupric bromide is dissolved in various quantities of water.

Most of the familiar salts of chromium are highly colored, and so are their solutions. Some of the latter exhibit the curious property of changing color when heat is applied to them. Dissolve some chrome alum (potassium chromium sulphate) in water, and the solution will be bluish red. Heat it to about seventy degrees centigrade, however, and it turns green.

The keen eye of a good chemist readily



In this experiment, blowing your breath through a solution causes it to change color amazingly

recognizes slight but significant color changes. Dissolve potassium bichromate (also called dichromate) in water, and you will obtain a reddish-orange solution. If you add a solution of potassium hydroxide or potassium carbonate, drop by drop, no visible change will occur for some time. Finally, however, the solution will take on a yellow hue, showing that all the potassium bichromate has been changed into potassium chromate. If you do not have a burette (a graduated glass measuring tube) to use as a dropper, you can improvise a substitute by fitting a medicine-dropper tip to a narrow glass tube, with the aid of a one-hole cork. The color change or "end point" of the reaction will be easier to see if you lay a sheet of white paper beneath the beaker or flask of solution. You need not bother to measure the quantity of liquid added, as a professional chemist would do with his graduated burette. This operation, called "titration," finds wide use in chemical analysis when the quantity of a substance in a solution is to be determined.

You can recover the potassium chromate produced in this experiment, for future use in your laboratory. Simply let the solution stand in a warm place for several days or a week, loosely covered to keep out dust, until the liquid evaporates. Then remove, bottle, and label the pale yellow crystals that remain.

All the hues so far described are the actual colors of chemical compounds or of their solutions. A different sort of color effect, resulting from the refraction of light by "colloidal" or finely divided particles suspended in a liquid, makes a striking laboratory demonstration.

This pretty display might be named the "blue sky, yellow dusk, and red sunset experiment." It was first observed by John Tyndall, famous British physicist of the last century. To reproduce it you will need a tall cylinder of clear glass, such as a

(Continued on page 126)

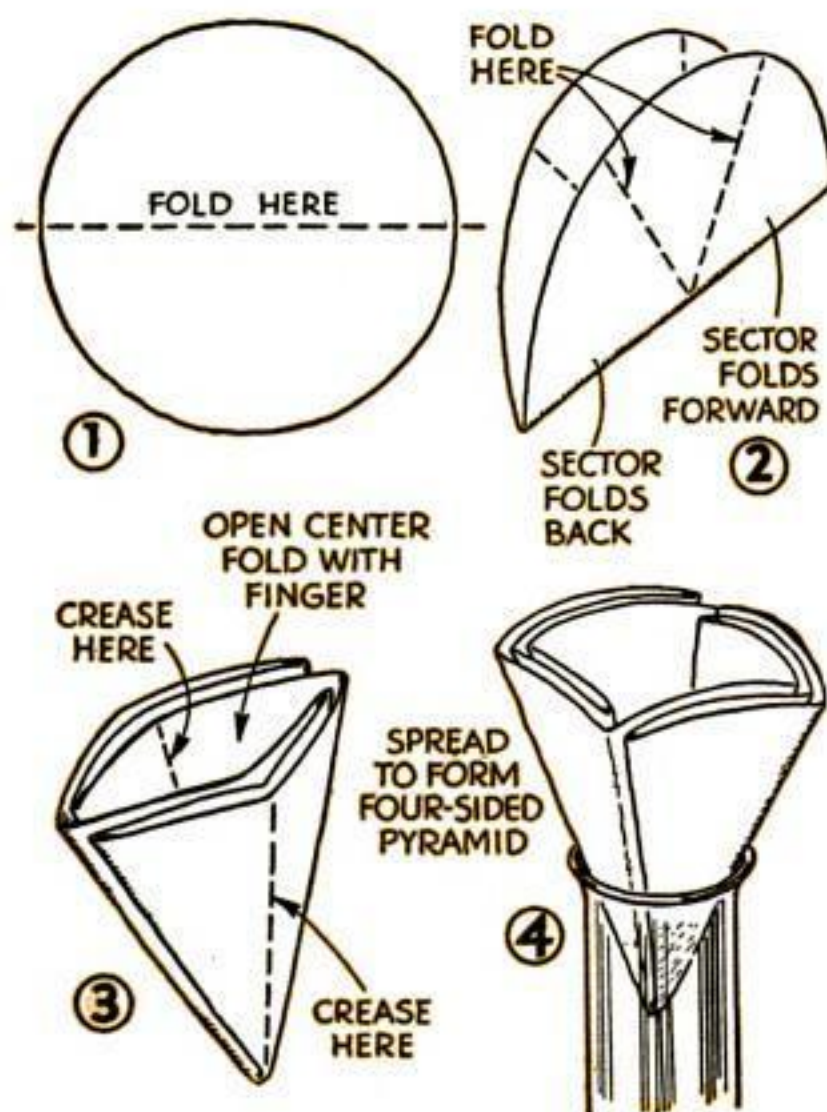
Folded Filter Paper Makes Funnel Unnecessary

TO FILTER small quantities of solutions, a disk of filter paper may be folded into the shape of a pyramid and slipped right into the mouth of a test tube, without requiring a funnel as a support. The accompanying diagrams, illustrating each step in

creasing the paper, show how the useful little trick is done. Three thicknesses of paper on every side give the filter enough firmness to enable it to hold its shape when filled with liquid. Its tapering form makes it grip the tube neck firmly.



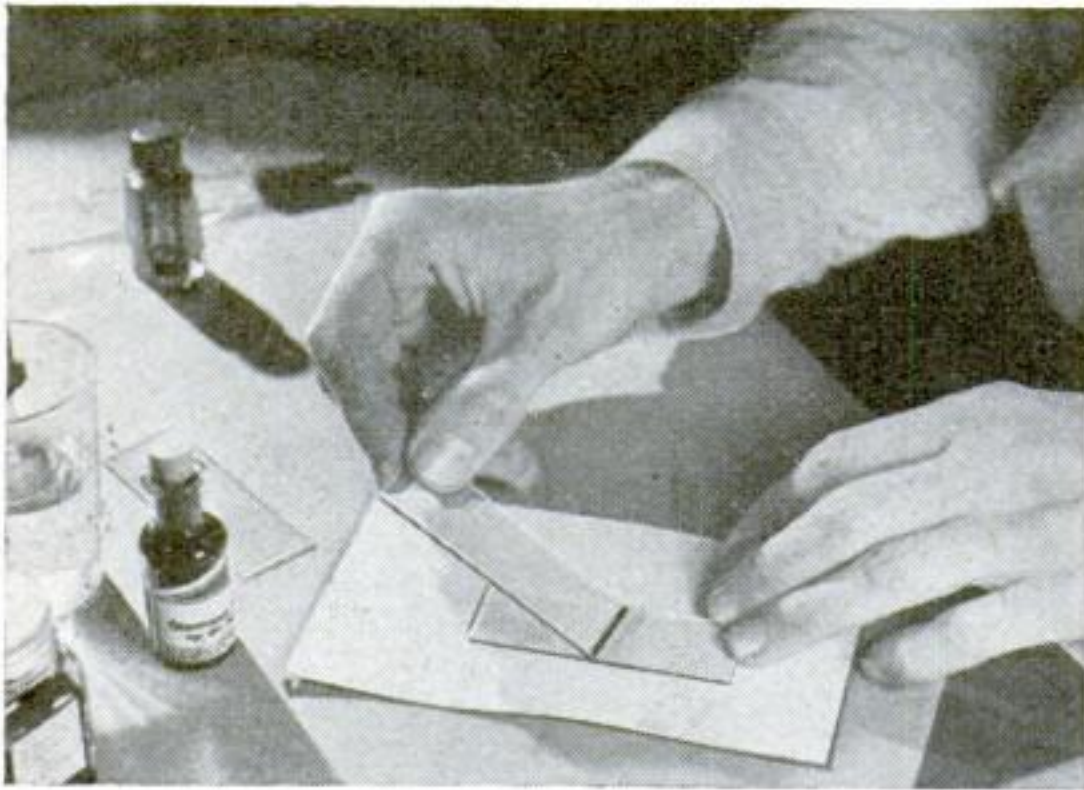
A disk of filter paper, folded into a pyramid as shown in the drawings, and slipped into the mouth of a test tube, will filter small quantities of liquid without a funnel



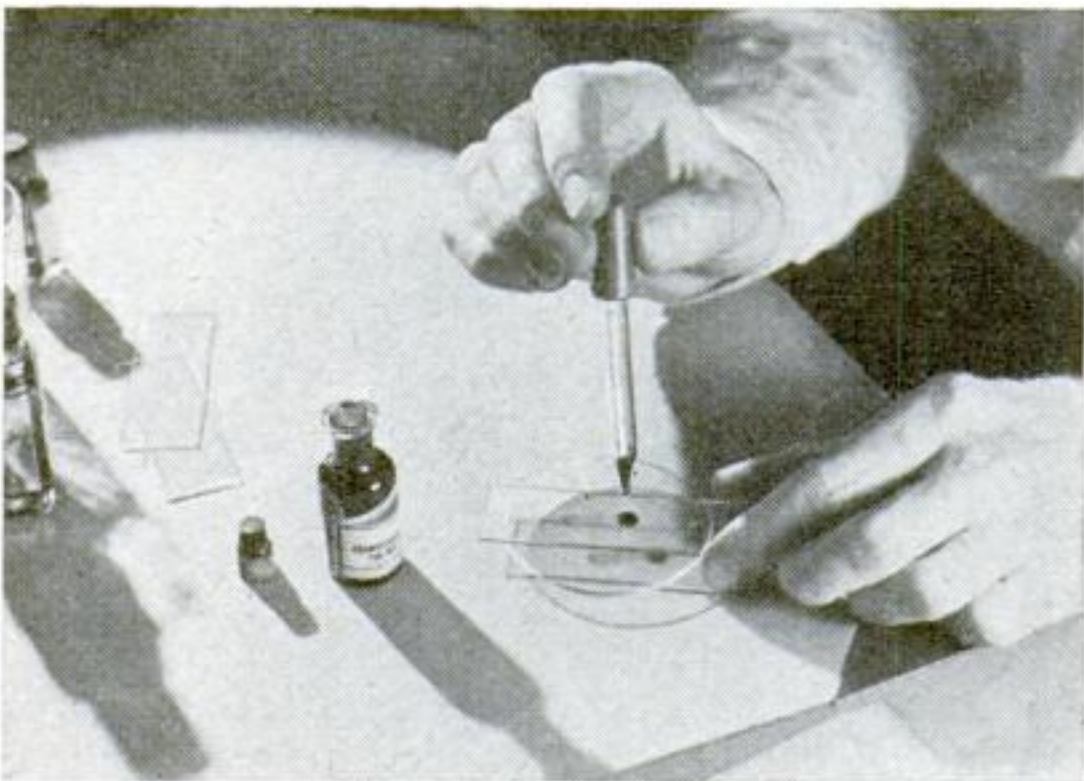
Help Your Microscope

How To Use Simple Chemicals To Bring Out The Obscure Details of Your Specimens and Reveal New Wonders to Your Magic Lenses

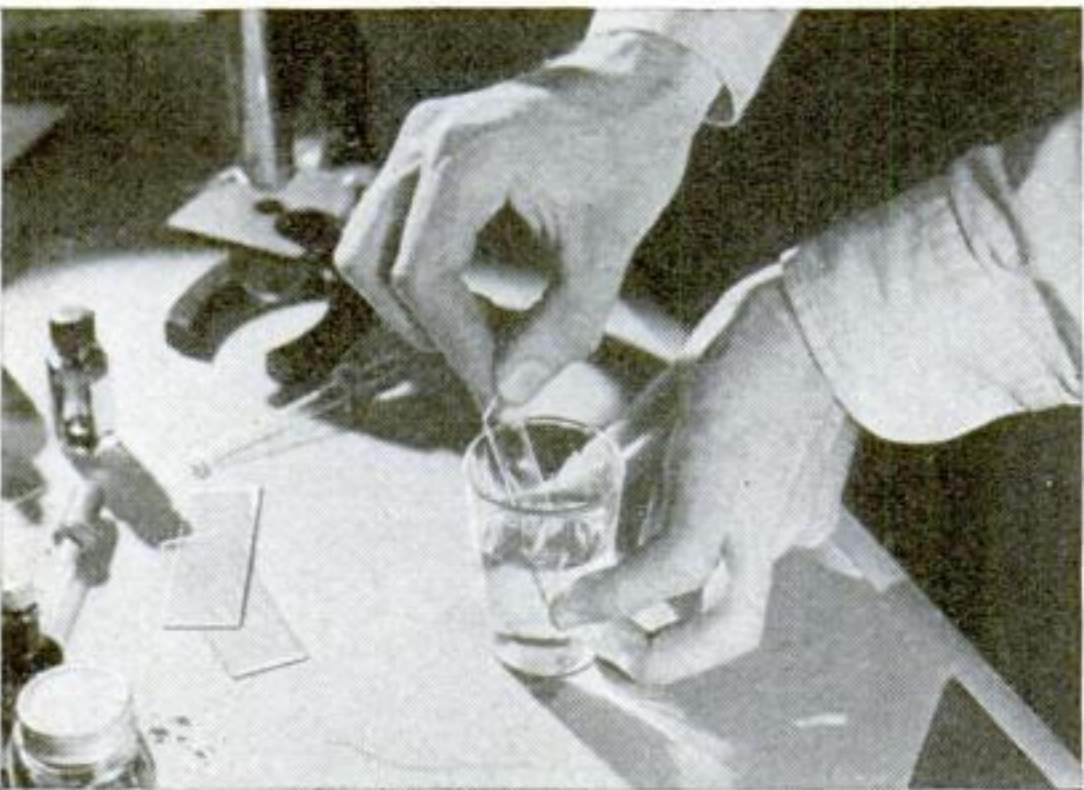
By Morton C. Walling



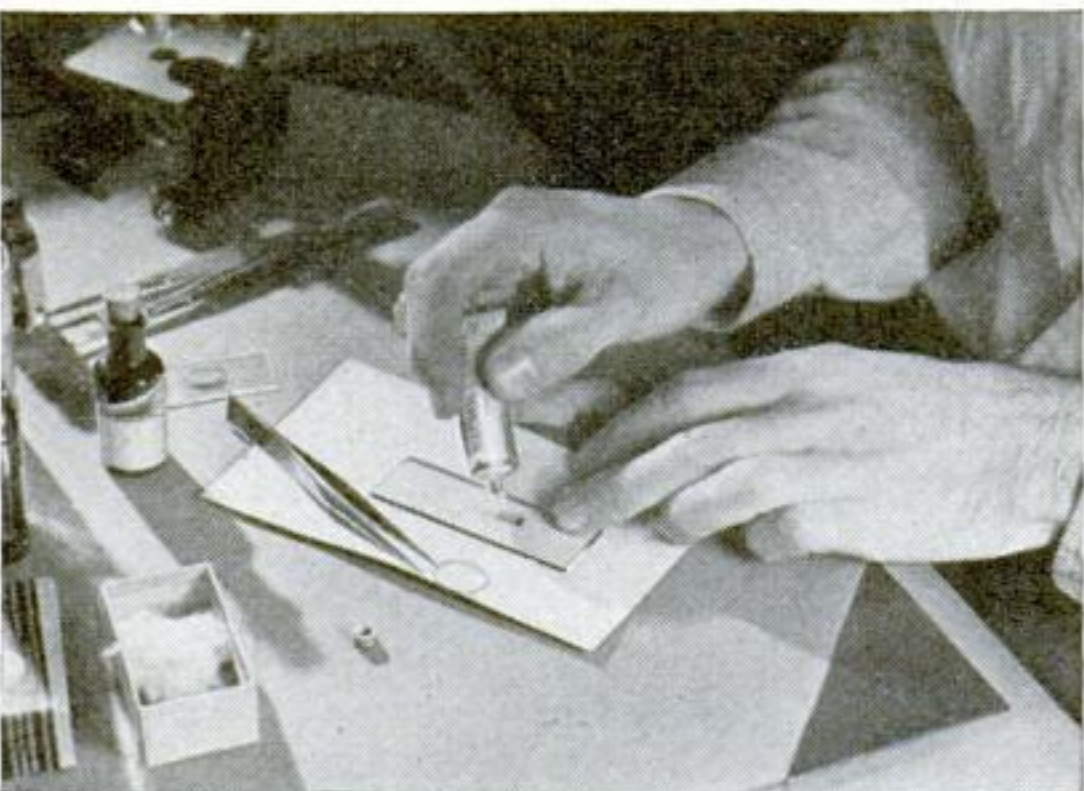
1 The first step in staining a specimen of blood. Spread the blood into a thin film or smear, either on a slide, as shown, or between two cover glasses



2 Dry, fix with alcohol, and apply the stain. Use a medicine dropper, or, for stains that act slowly, immerse completely, as shown on the opposite page



3 The stain, in this case a commercial product, is rinsed away with water. Distilled water is, of course, best. Dry the slide, keeping it free of dust



4 After drying, the specimen is ready for examination. Although the blood smear is surprisingly durable, attach a cover glass permanently with balsam

CAN you give information about any of the following stains and reagents, as to use, and the preparation and treatment of the specimen?"

That is what one microscope fan asks. And he lists exactly thirty-nine items, some of which are commonly used in microscopy, and some of which are seldom mentioned outside of a well-supplied laboratory. But his question is typical of a great many asked by amateur microscopists—questions justified by the importance of stains and other chemicals in the proper pursuit of this fascinating hobby.

The use of aniline dyes and other staining materials in microscopy is, very frequently, much like the administering of a magic potion. The resulting changes are so wonderful and beautiful that, to the observer who has never before seen anything of the kind, they are little short of miraculous.

Stains are applied to specimen material for several reasons. They color otherwise indistinct objects and make them easy to see. Bacteria provide an example. They color parts of objects, making them stand out from other parts. Sometimes two or more colors are used for this. Thus, in work with animal tissues, it is a common practice to stain cell walls one color and nuclei another. Stains add to the beauty of an object, such as the cross section of a plant stem. This may not be of primary importance to the scientist, who is trying to differentiate between parts of the structure rather than make them more beautiful; but to the amateur, who is pursuing his hobby largely because it is fun, this reason for staining may be more important than the others.

Specimens may be stained either in bulk or in sections. That is, chunks or pieces of the material, or the whole insect or small animal, may be immersed in the stain; or it may be sliced into thin sections and each section stained after it has been transferred to a slide. The second method is perhaps the better, where material is sectioned. Of course, bacteria, very small insects

and the like are stained in bulk, but they are handled very much as if they were sections.

Generally speaking, microscope stains can be classified into three distinct groups of materials. The first group, consisting of common household substances like iodine, are particularly popular with the amateur because they are inexpensive and readily available. Eosin, a red dye, and methylene blue are good examples of the second group of stains which consists mainly of substances that belong definitely to the art of microscopy. The third class is a group of commercially prepared stains sold under brand names like patent medicines. These commercial stains, as well as those in the second group, can be obtained from any dealer in microscope supplies.

Iodine has been mentioned as a readily available stain; mercurochrome is another. As a matter of fact, almost any soluble coloring ingredient can be used with some degree of success. Household dyes and water-color paints sometimes work very well. One of the simplest and most dependable stains for use with the well-known slipper-shaped paramecium is ordinary writing ink, and the technique is very easy to master.

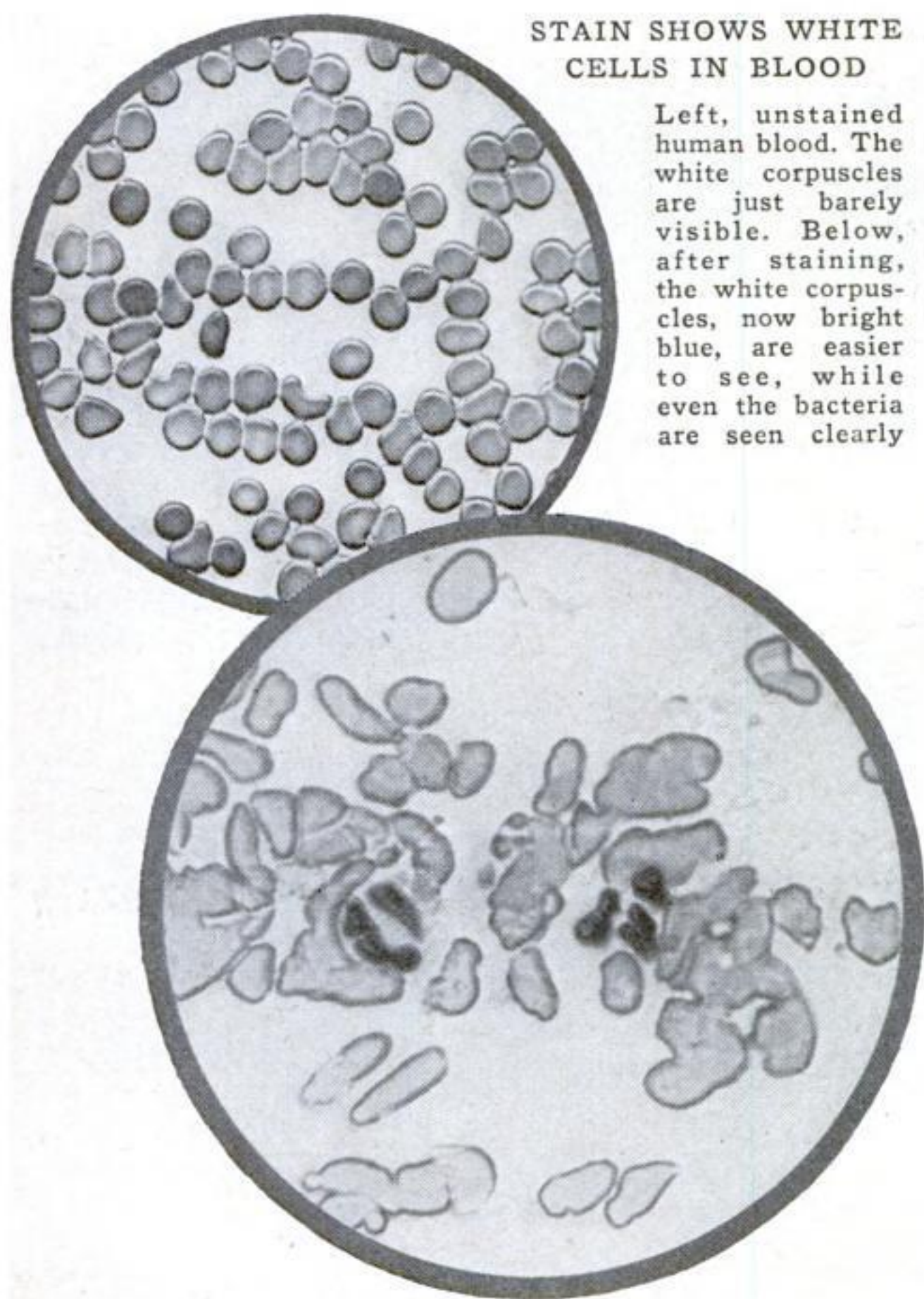
Put a drop of water that contains paramecia on a slide, add a cover glass, and focus the specimen. Now remove the cover and apply a little red ink with a toothpick or the head of a pin. When the cover glass is replaced, examination will show that the staining has made the trichocysts, or stinging organs, and the hairlike cilia stand out clearly. After about four minutes, take a fountain pen containing blue ink, and touch its point to the edge of the cover glass. Watch the reaction through the microscope. As the blue ink is drawn in under the cover glass, observe the paramecia plunging into the advancing wave of blue. The cytoplasm, or main part of the single-celled creature, turns a beautiful, deep red with a purplish tinge; the eyelashlike cilia become flame-colored, and the defensive trichocysts are a deep blue.

Among the special microscope stains which fall into the second classification, there are so many useful chemicals that it is difficult for the beginner to decide which to buy first. The one that should be at the head of every microscopist's shopping list, however, is eosin. For general work, both water and alcohol solutions should be kept on hand. Another useful stain, which is particularly suited

with Stains and Reagents

STAIN SHOWS WHITE CELLS IN BLOOD

Left, unstained human blood. The white corpuscles are just barely visible. Below, after staining, the white corpuscles, now bright blue, are easier to see, while even the bacteria are seen clearly



Staining a slide by complete immersion. Because many stains call for prolonged soaking, it is worth while to secure a special glass vessel like the one shown

for work with bacteria and plant material, is methylene blue. Safranin also works well with plant tissues, while methyl green and neutral red can be used for any living specimens.

Although haematoxylin often is used in conjunction with eosin for double-staining animal tissues, and with safranin for plant material, it also can be used independently for plant life, producing a rich, purple color that is well worth observing.

Select a leaf stem from a plant such as a geranium, and cut several thin specimens with a wet razor blade. Mix half haematoxylin and half water, and soak one of the specimens in it for ten or fifteen minutes. Remove the plant material, wash it in water, and soak in alcohol for a few minutes. Then immerse it in aniline oil until clear, and wash for a minute or two in xylol to remove the oil. Keep the specimen wet with xylol while you are examining it under a cover glass. If it is a good section, make it a permanent mount in balsam.

Blood is not easy to stain, but it can be accomplished with a fair degree of success with nothing more than eosin.

Put a thin smear of blood on a cover glass, and allow it to dry overnight. The next day, place the cover glass, blood side up, on a metal plate, and heat it gently for about a half hour. When the glass has cooled, apply a drop of eosin, spreading it evenly over the surface, and allow this to remain for half an hour. Next, wash away the excess stain in water, and dry the specimen by touching a piece of blotting paper to its edge.

Whatever moisture remains can be removed by holding the cover glass over a small flame for a few seconds. Put the glass, blood side down, on a slide, and examine. You will be able to see the red corpuscles, or oxygen carriers of the blood, stained pink. The white corpuscles, not affected by the stain, will not be readily visible. A special technique is needed to color them.

For complete staining of blood, and for other specimens which present special problems, the amateur is advised to use one of the special commercial stains that are available. The method of using a typical prepared stain is shown in the photographs that accompany this article. Some of these special formulas are available to anyone who consults the textbooks on the subject, but it is usually not worth while to attempt making them up at home when they can be purchased already mixed at reasonable prices.

Certain stains require a rather complicated procedure; others are simple to apply. Some are ready for use as soon as they are mixed, others have to "ripen" for a few days, or even months. Some do their work in a matter of seconds, others must soak into the specimen for several hours, or longer. The staining operation is often made more successful by the use of various other substances; fixers, dehydrating materials, hardening agents, solvents, and mounting media all



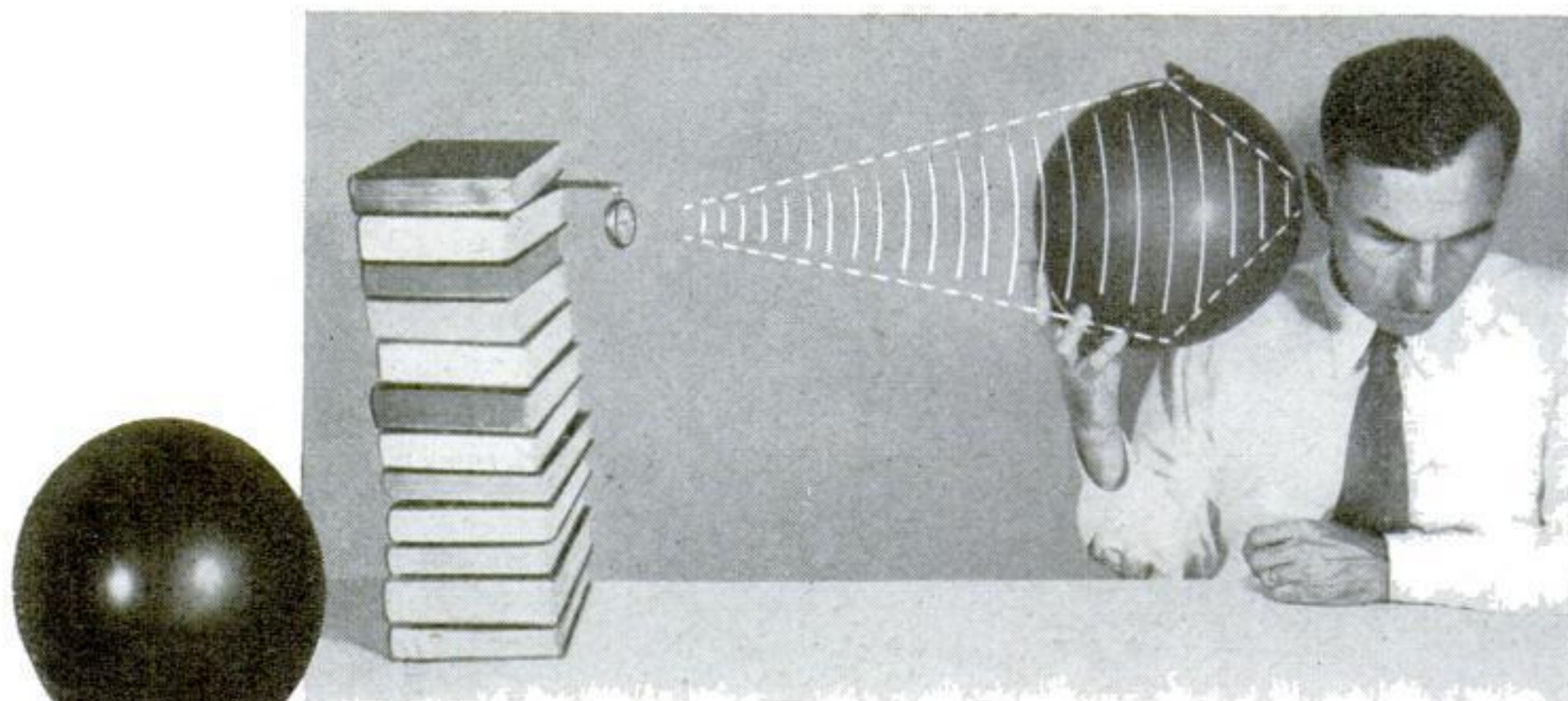
Cross section of a flower anther stained to make the cell nuclei prominent. Note the pollen grains

are closely related to stains. To help the microscopist to make an intelligent choice among the numerous stains and reagents he needs, a special bulletin has been prepared, listing the common stains and other chemicals used in microscopy, along with the properties of each, and directions for using them. If you wish to receive a copy of this bulletin, send a large, stamped envelope to the Microscope Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York City.

Laws of Science

SHOWN BY EASY

HOME EXPERIMENTS

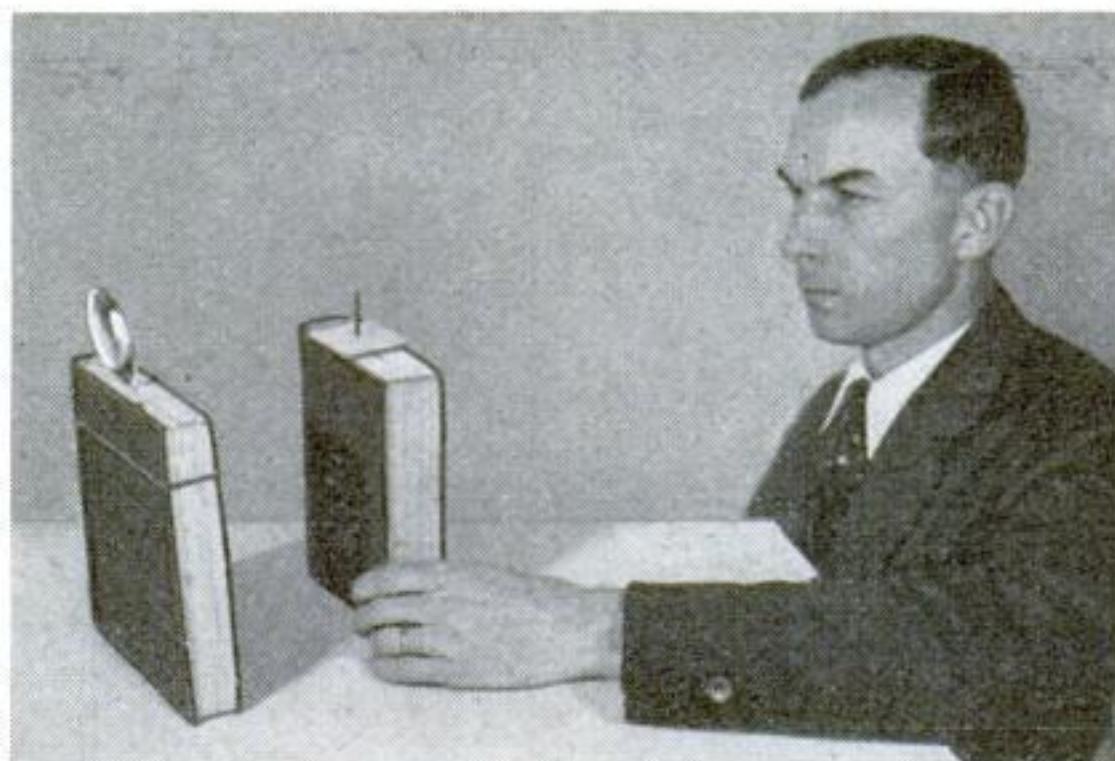


Gas-Filled Balloon Magnifies Sound

THAT sound waves can be bent, just as light waves are "refracted" by a lens, is proved by means of a balloon filled with carbon dioxide gas generated by placing limestone in muriatic acid, as shown at the left. Hold the balloon close to your ear, and sounds such as the ticking of a watch are greatly magnified.

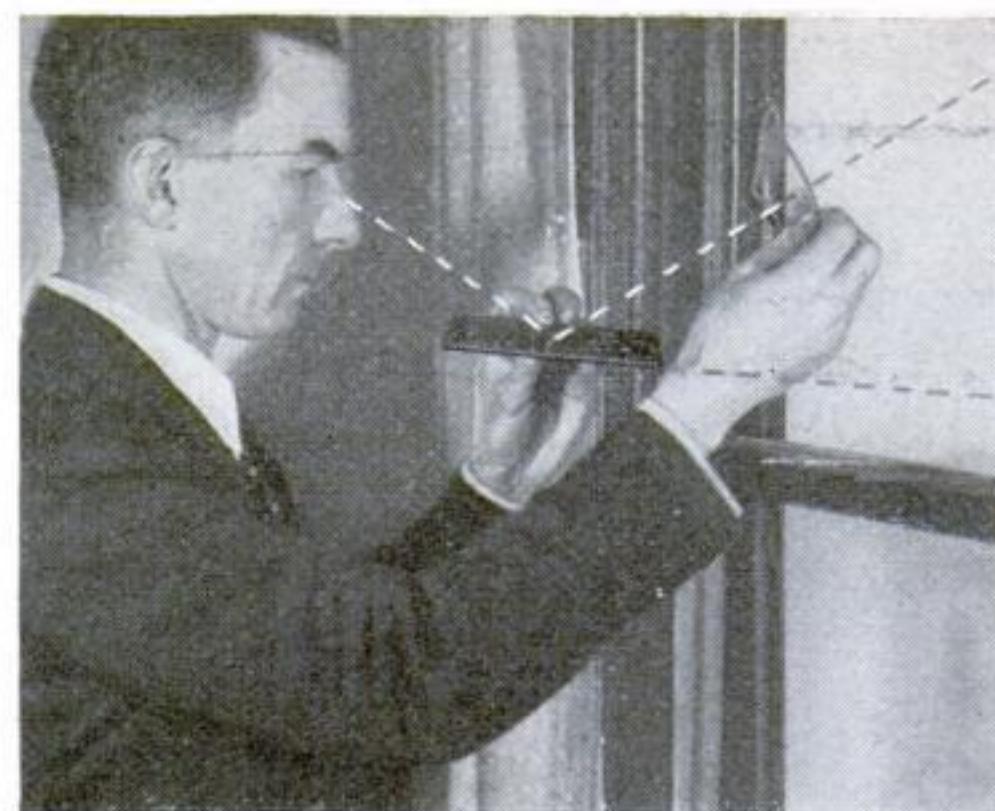
Focal Length of Lens Is Easily Measured

FOCAL LENGTH of a magnifying lens can be measured by sighting over a nail and through the lens at some object about 100 feet away. Move your head from side to side. If the nail appears to move faster than the object, shift it toward the lens; if it seems to move slower, bring it away. When they move together, distance from nail to lens is the focal length.



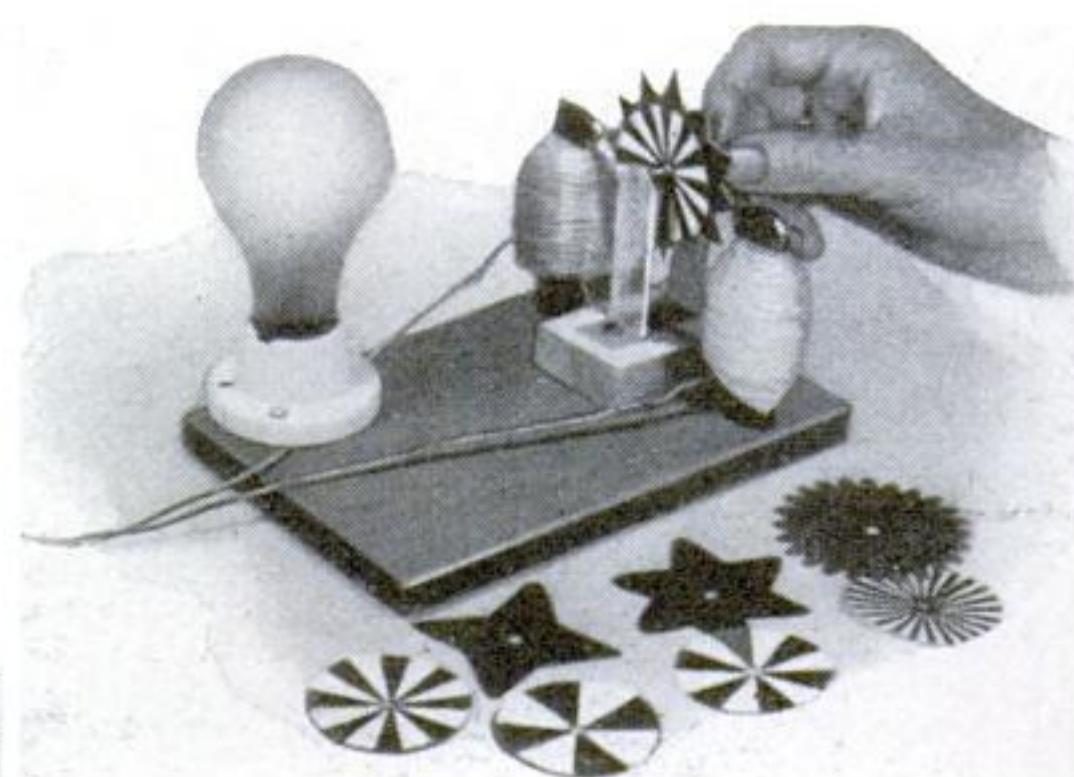
Top Illustrates Spiral Nebulæ

You can demonstrate some interesting facts about centrifugal force with a large top made from a disk of cardboard and a pointed stick. Place several large drops of water on the disk and give it a vigorous spin. The drops are thrown outward, making spiral tracks on the disk. Traced in ink, these spirals resemble those seen in photographs of spiral nebulæ. It also is interesting to note that after flying off the disk the drops travel in straight lines which, when extended backward, form tangents of the disk.



Test of Polarized Light

TO OBSERVE the effects of polarized (one-way) light, reflect the light from a blue sky with a piece of glass, as above. Hold a piece of mica in its path, and a marvelous color display will be seen. The effect is caused by the blue rays from the sky, polarized as they pass through the atmosphere.

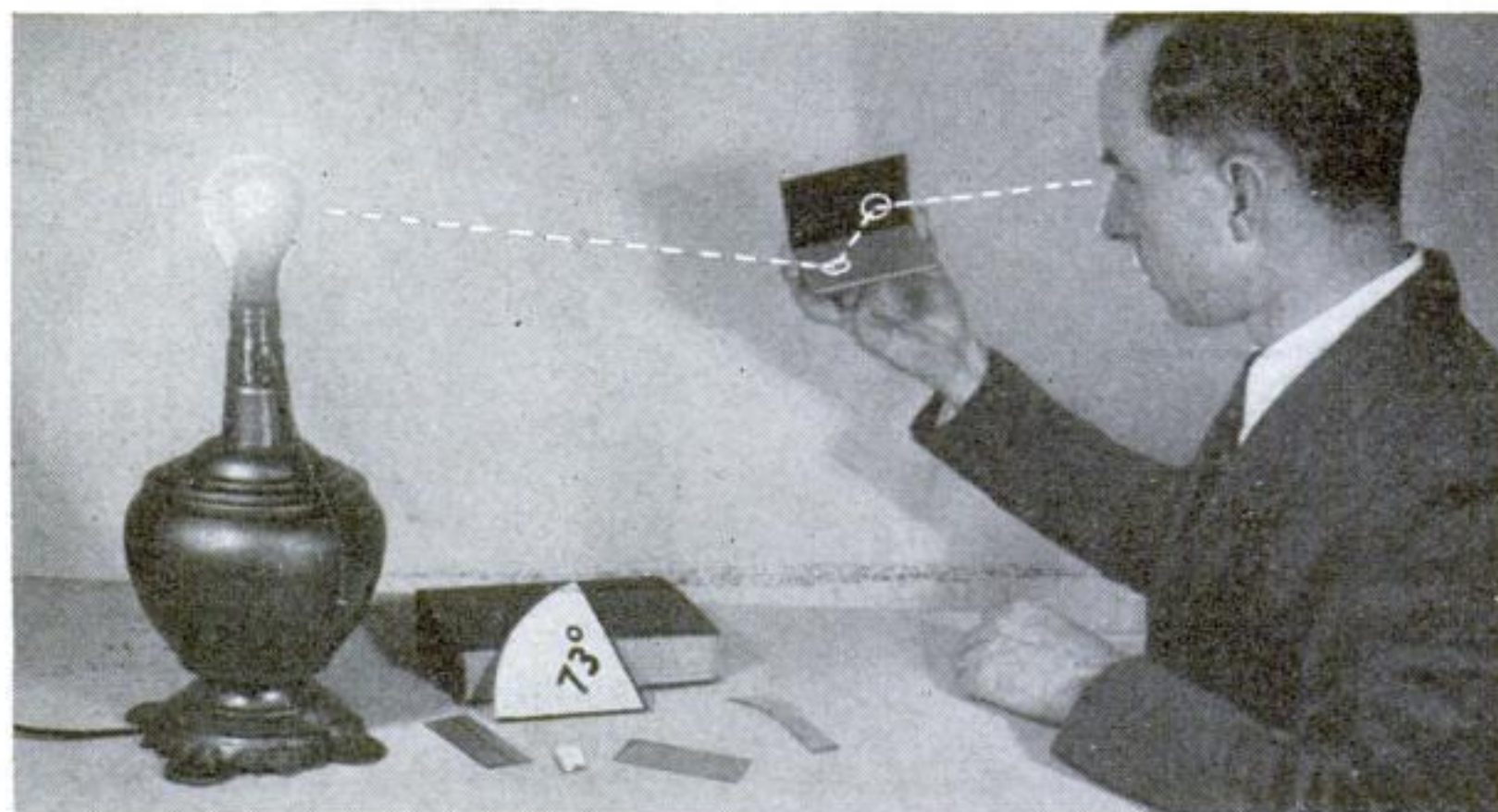


How Electric Clocks Run

A NOTCHED tin wheel, rotating between the poles of a U-shaped electromagnet connected in series with a lamp to a 110-volt alternating-current circuit, illustrates the synchronous motors of electric clocks. Started by hand, the wheel will spin at a constant rate, as shown by the fact that segments painted on a cardboard disk attached to it will appear to stand still.

One-Way Light Makes Lamp Vanish

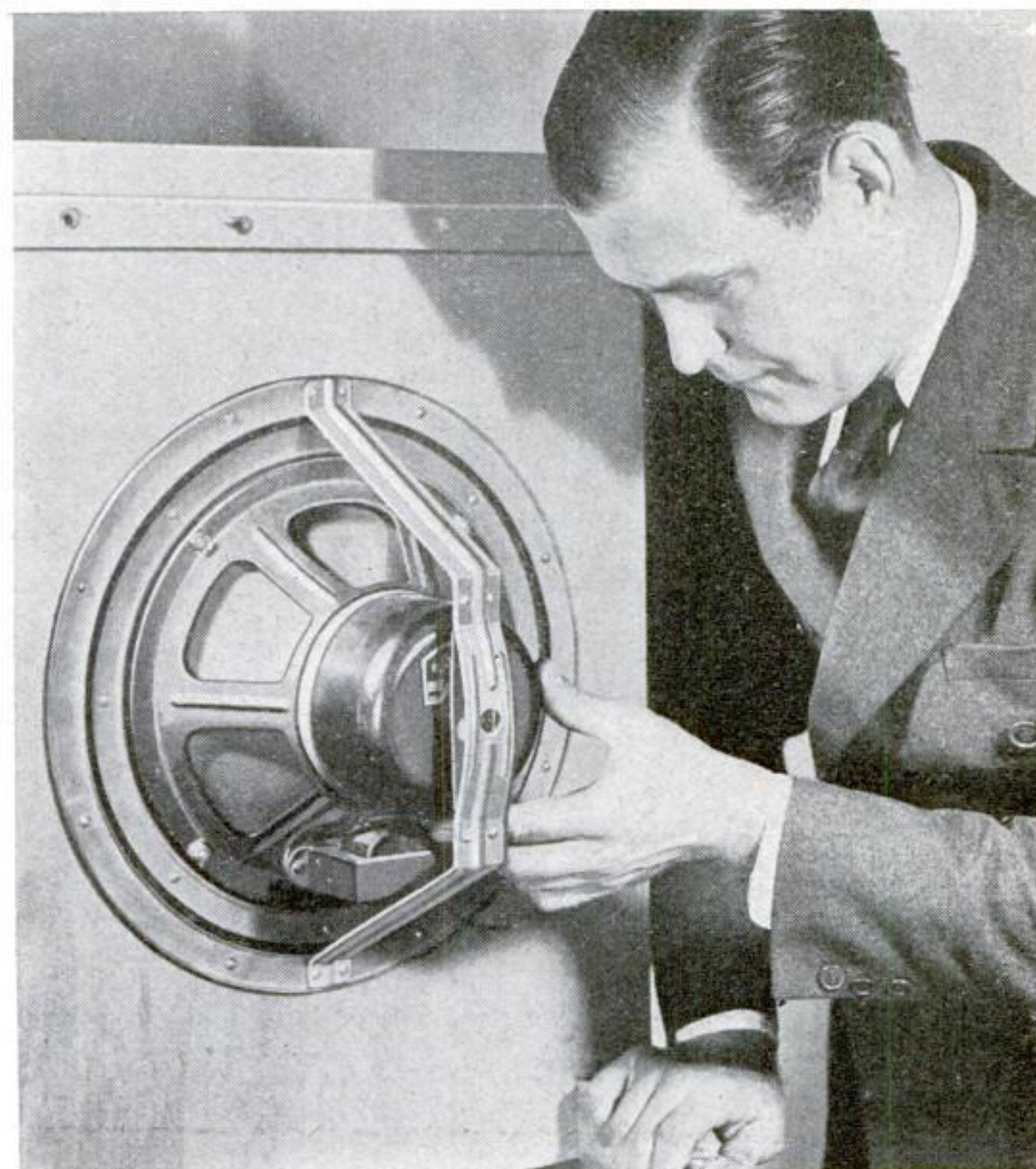
Two small pieces of ordinary window glass are all you need to demonstrate the one-way effect of polarized light. Hold them so that they form a seventy-three-degree angle and reflect the light from a lamp bulb, as shown in the photograph. When the proper position is found, the reflected image of the bulb will be practically invisible, because the first reflection polarizes the light and the second glass receives it at such an angle that it will not reflect it. Circles marked on the glasses, as shown, help in obtaining the position that gives best results.



A PAGE OF NEW IDEAS For the Radio Fan

Floating Speaker Eliminates "Boom"

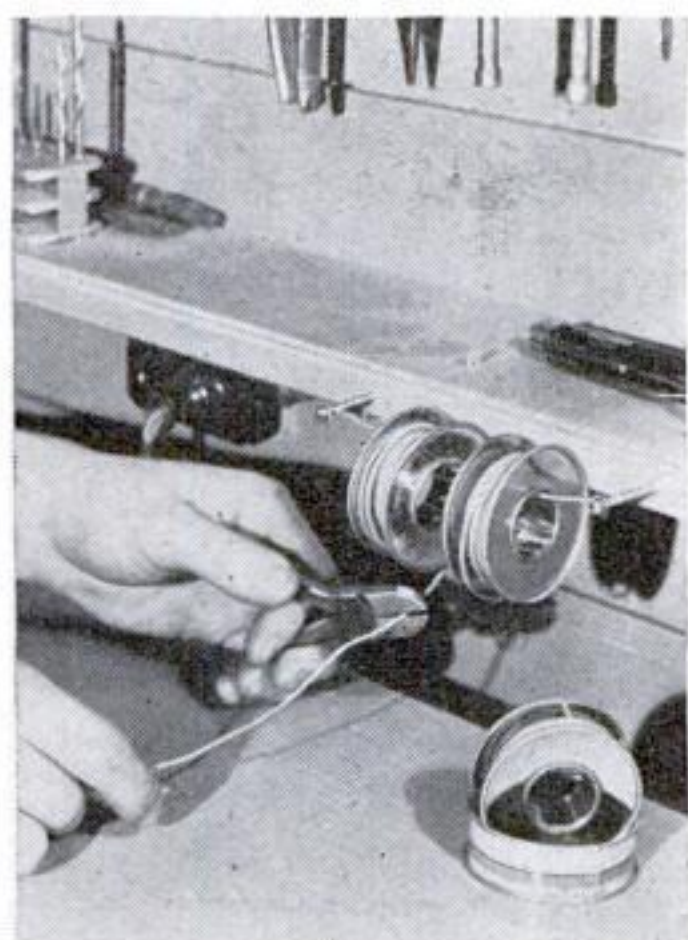
OVEREMPHASIS of certain frequencies, often made evident to the listener by a "boom" or "barrel" effect, especially in the bass range, is eliminated by a new loudspeaker mounting. Instead of being fastened rigidly to the sounding board of the cabinet, the speaker is mounted in live rubber, while a flexible spring mounting supports it at the rear. Excessive vibrations which an ordinary speaker mounting would transmit directly to the sounding board are absorbed by movement inside the flexible mounting before they can reach the front panel.



Rear view of speaker, showing spring mounting that absorbs vibration

Handy Metal Spools Hold Hook-up Wire

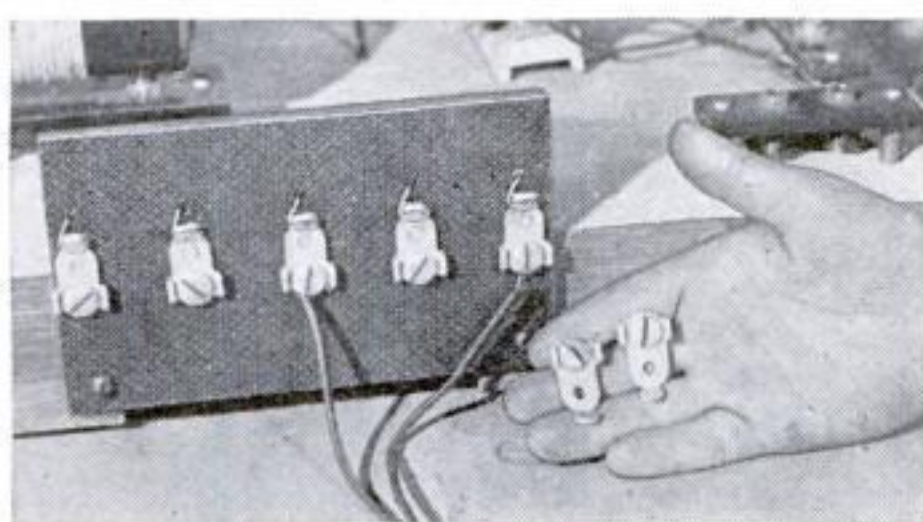
HOO-K-UP WIRE is now being supplied in twenty-five-foot lengths on handy metal spools similar to those commonly used for adhesive plaster. This is a neat and convenient form for the workbench. As shown in the illustration at the left, several spools can be strung on an accessible shelf edge, and desired lengths can then be cut off quickly and easily without the remainder getting tangled. Wire in a wide range of sizes and in different colors of insulation is available in this new, convenient form.



Wire is unrolled from spools and cut off as needed without tangling

Individual Screw Lugs

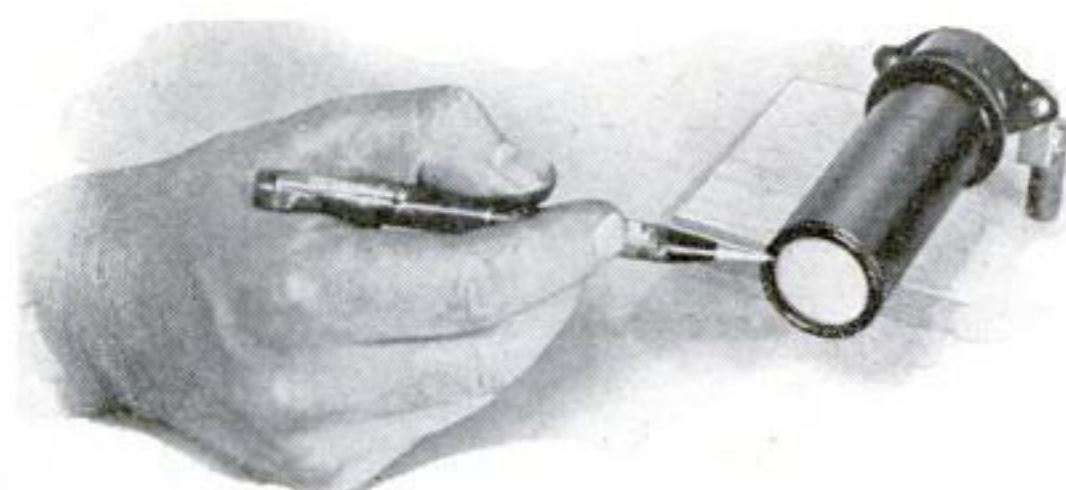
PROFESSIONAL-LOOKING terminal boards for home-built apparatus are made possible by the use of a new individual screw lug which fastens to the panel by a single machine screw. The small end of the lug is bent out slightly to facilitate the soldering of the permanent inside connections.



These screw lugs are easily attached to any panel

Tiny Cathode-Ray Tube Aids Experimenters

WITH a new low-cost cathode-ray tube, the experimenter can provide his home laboratory with an inexpensive oscillograph for studying electrical wave forms. Only one inch in diameter and four inches long, the midget unit is in all respects but size a technical counterpart of the larger tubes.



Pencil points to the screen on which images appear

Adjustable Transformer Gives Voltage Control

SMOOTH, stepless voltage control for A.C.-operated radio and electrical devices is afforded by a new type of adjustable power transformer. Having sliding carbon brushes which make contact with an exposed layer of the windings, it eliminates

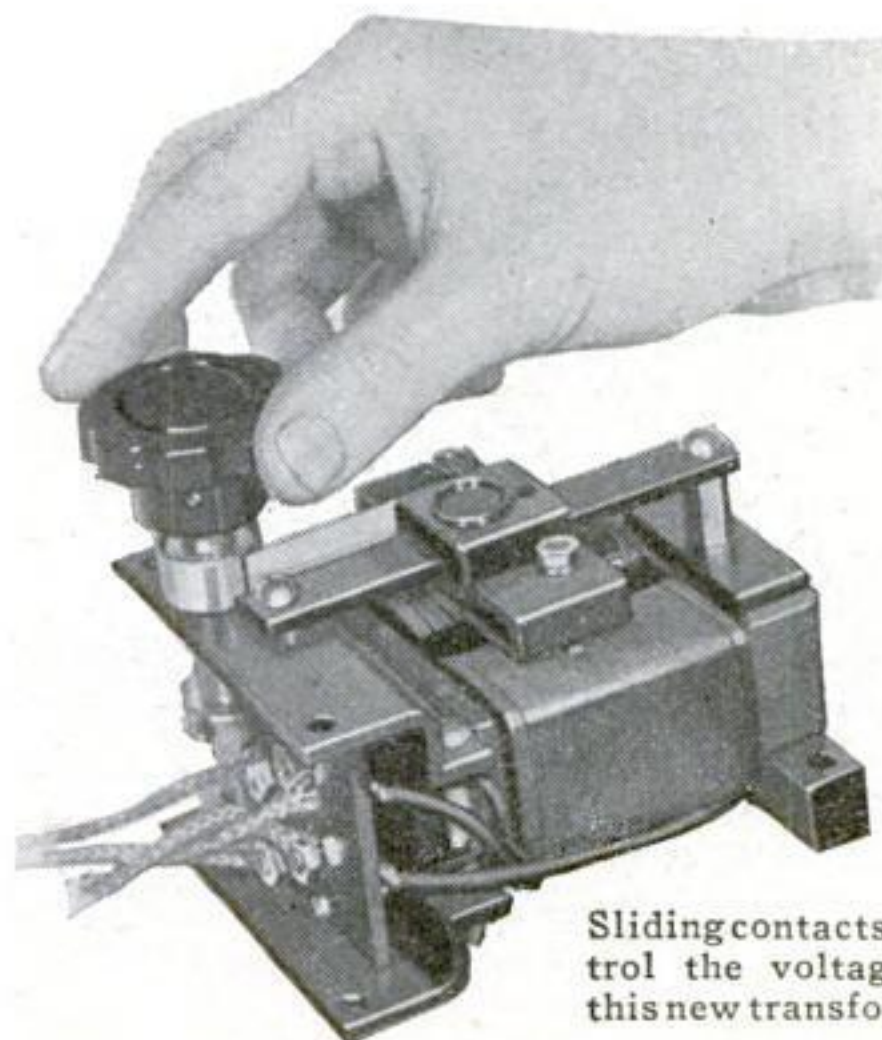
the need for rheostats or other power-wasting elements. Seven models, rated from fifty to 2,000 watts, are available, with a wide choice of output voltages. The unit illustrated is rated at fifty watts and delivers up to ten volts.

Crystal Pick-up Fits on Violin

USERS of sound amplifiers who are faced with the problem of "bringing out" comparatively weak instruments in an orchestra will be interested in a new crystal-type pick-up which is placed in contact with the tail piece of a guitar, violin, or mandolin, and responds directly to the musical vibrations. The crystal element is inclosed in an aluminum case, to which is attached a twenty-five-foot connecting cord.

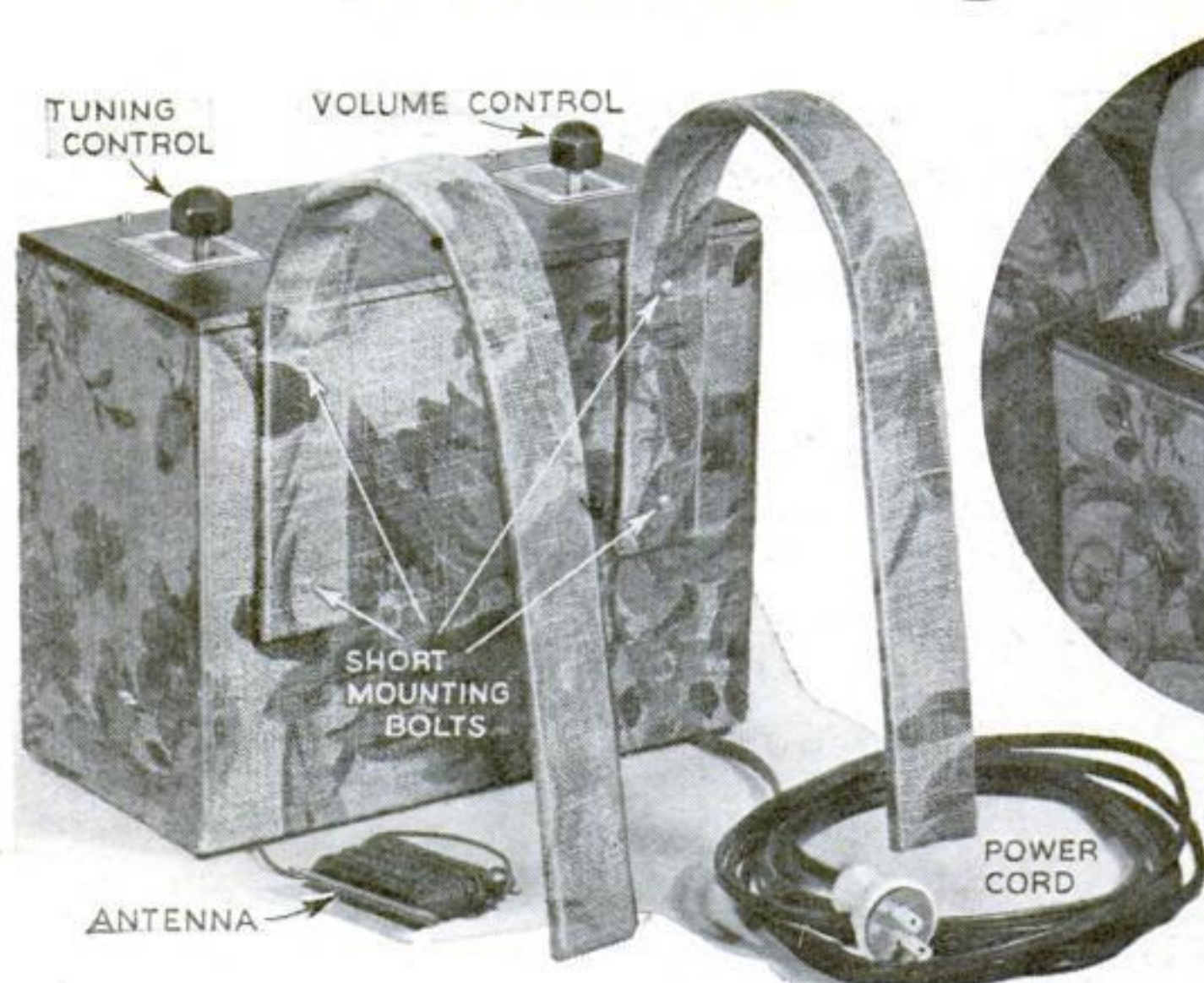


Violin fitted with an inconspicuous pick-up to amplify its music



Sliding contacts control the voltage of this new transformer

Arm-Chair Radio Set



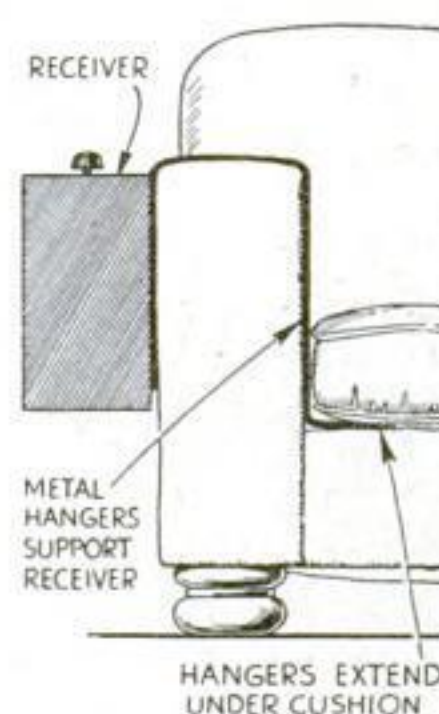
By
CLARK MAXWELL

AFTER trying for several years to find a convenient yet inconspicuous place for the radio in our living room, I decided to solve the problem once and for all by designing a special receiver that could be hung on the arm of my favorite reading chair. The result—the “arm-chair five,” as I have dubbed it—is shown in the photographs. Now, when I spend an evening reading, I have everything that the radio programs have to offer right at my finger tips.

The circuit, as a glance at the diagram will show, is a straightforward, tuned-radio-frequency hook-up powered by an A.C.-D.C. power supply. Using four of the newest all-metal tubes, it employs a 6K7 as a radio-frequency amplifier, a 6J7 as a biased detector, a 25A6 as the power amplifier, and a 25Z6 as the rectifier. A fifth tube, a glass unit (185R), is a new plug-in resistor which supplies the necessary filament resistance to reduce the 110-volt house current to the required value. The use of this tube eliminates the usual bulky built-in resistor power cord found on most A.C.-D.C. receivers.

In building the aluminum chassis, I used an ordinary commercial two by four by nine-inch A.C.-D.C. chassis, drilled to take five sockets, as the base. On this, I constructed a superstructure consisting of a four by nine-inch aluminum panel supported on two five-inch-high, S-shaped aluminum brackets. The panel serves as a mounting surface and support for the two tuning controls—the two-gang variable condenser (C_1 and C_2) and the volume control (R_1). To obtain the necessary rigidity, sheet aluminum at least one sixteenth inch thick should be used.

The five wafer-type tube sockets, one tuning coil (L_1), and the five-inch dynamic speaker are mounted on top of the chassis base, while the fixed condensers, resistors, and second tuning coil are placed under the chassis. By arranging the parts



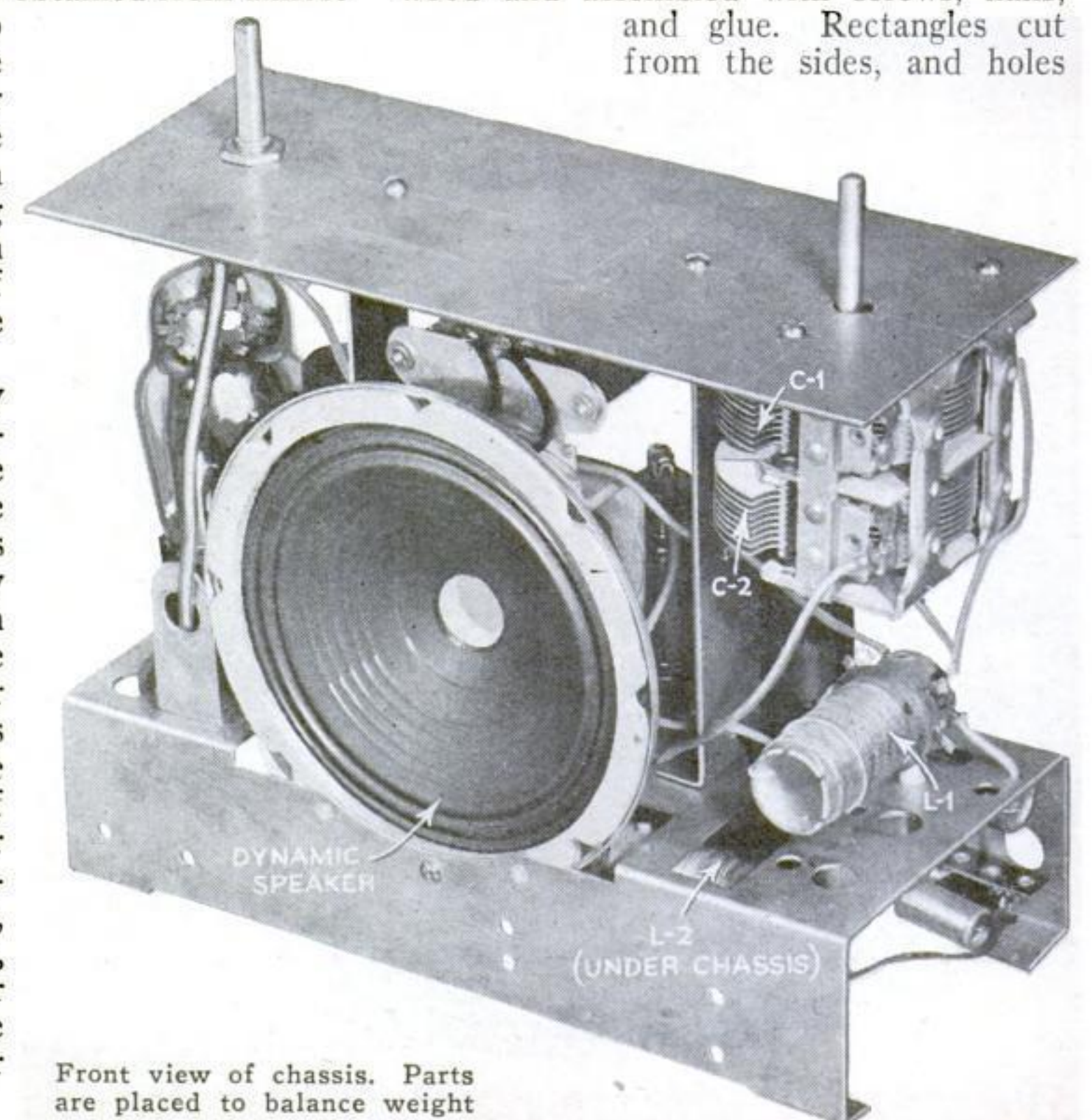
The “arm-chair five” in use. Housed in a cabinet that is covered with tapestry to match the upholstery, it hooks over the arm of a favorite chair or sofa. Specially designed for the purpose, the receiver has its tuning controls placed conveniently on the top, and is both light and compact

symmetrically, as shown, the weight will be evenly distributed and provide good balance.

To give best results, the two matched tuning coils (L_1 and L_2) should be Litz-wound. These can be obtained from almost any dealer in radio parts and should be bought as a pair or set. They can be mounted easily on the chassis with long bolts passed through short sections of dowel rod to provide insulation.

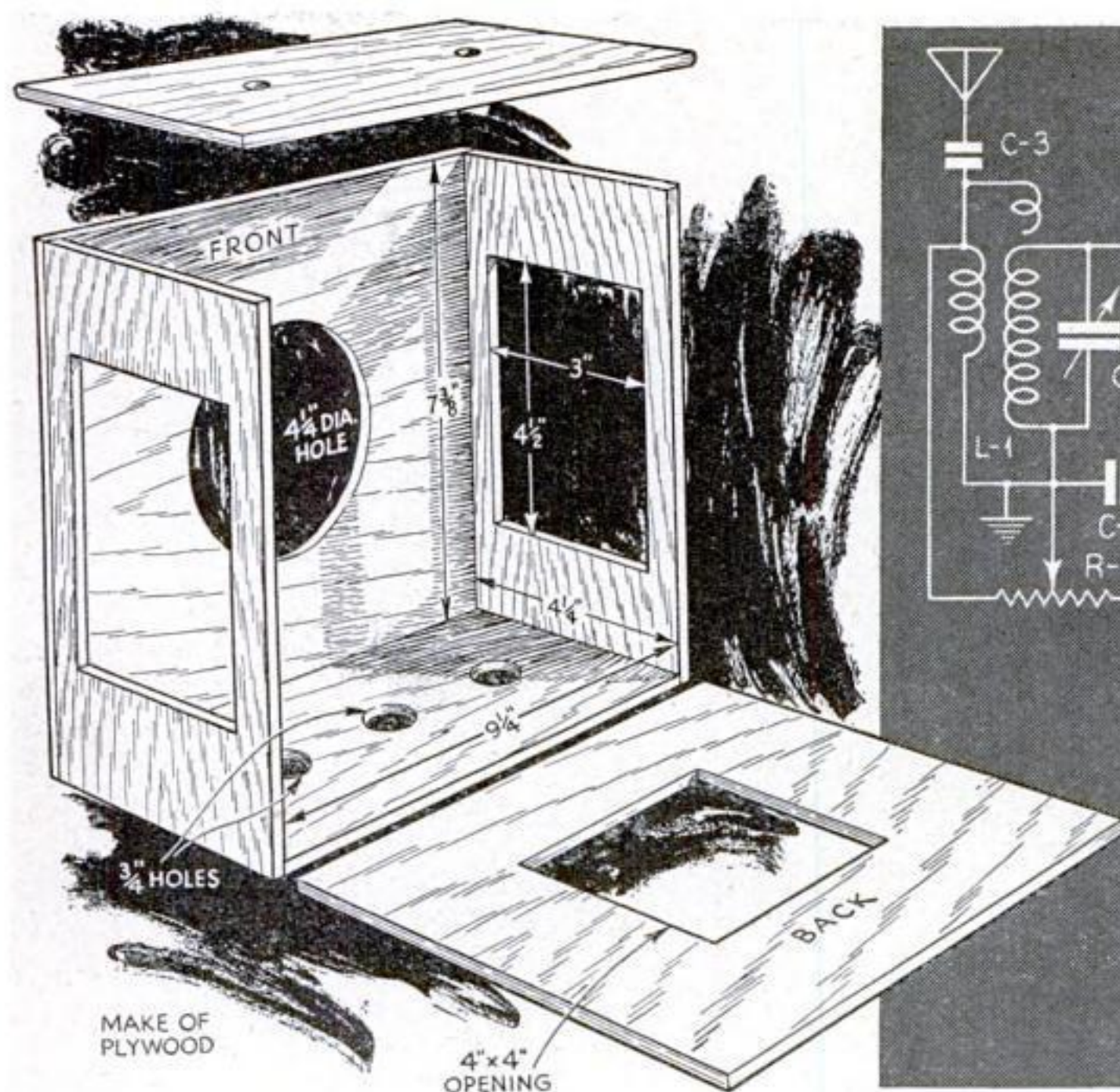
Little difficulty should be experienced in wiring the parts, provided the circuit diagram is followed closely. Pay particular attention to the wiring of the power-supply filter circuit. To save parts and cut down on the cost, the field coil of the dynamic speaker is wired into the circuit as a filter choke, while a two-watt, 5,000-ohm resistor (R_6) serves in place of the second filter choke.

Consisting of a wood box covered with upholstery material, the cabinet must be constructed to give good ventilation to prevent overheating of the tubes. As shown in the drawings, it is made of plywood and assembled with screws, nails, and glue. Rectangles cut from the sides, and holes



Front view of chassis. Parts are placed to balance weight

Made of Standard Parts

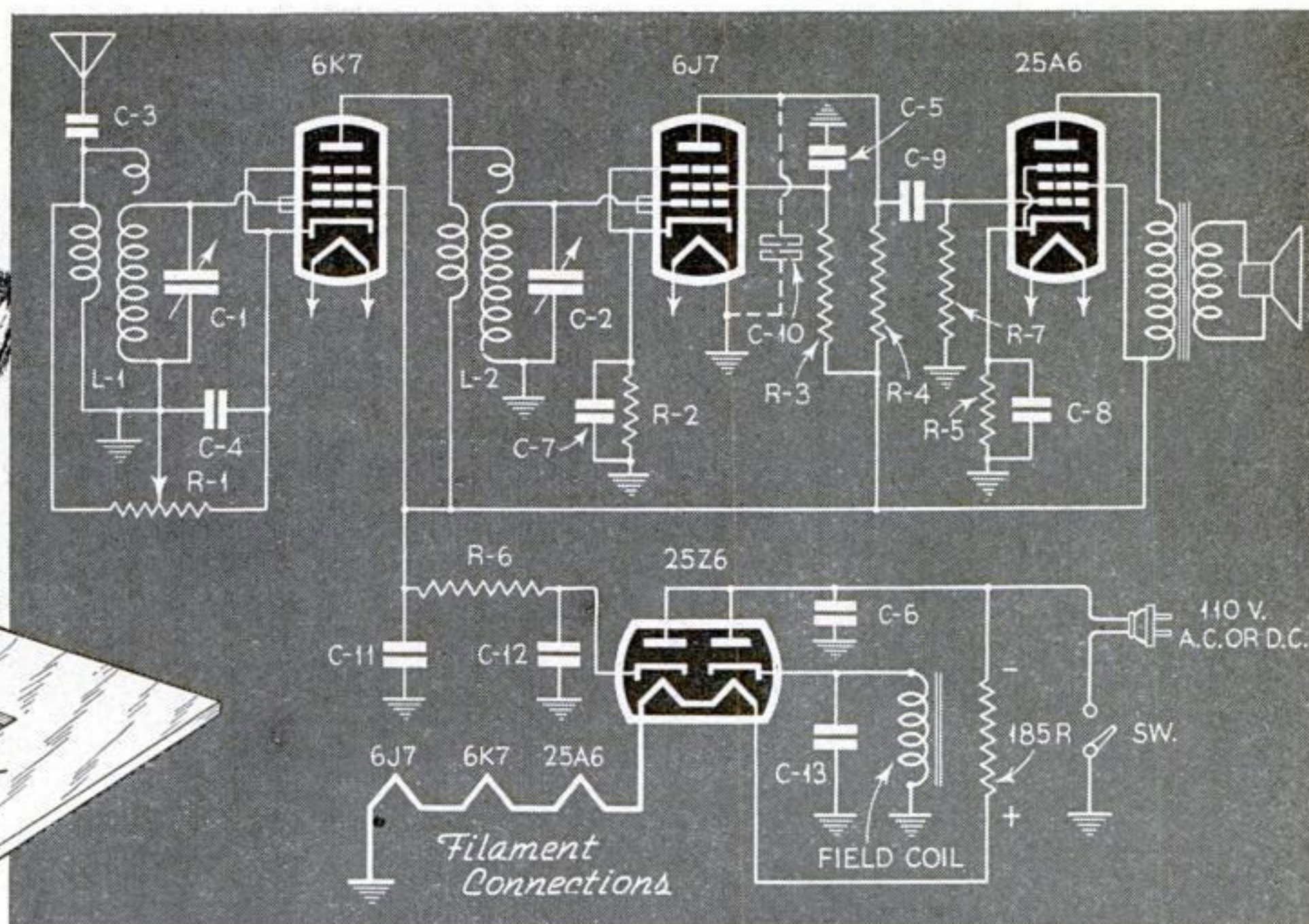


drilled in the bottom, provide a good circulation of air, while a hole cut in the back behind the speaker eliminates any possibility of bothersome rumbles and rattles.

To provide a cover for the aluminum panel, an attractive top for the cabinet can be fashioned from a piece of mahogany, maple, or pine. This can be fastened in place with four screws.

When buying the covering material for the cabinet, select a cloth that is loosely woven. With a little shopping around, it will not be difficult to find just the right color, texture, and weight to match your upholstery. The cloth is applied to the cabinet with glue.

In constructing the upholstery-covered arm hooks that hold the receiver



The circuit is a straightforward, tuned-radio-frequency hook-up, powered by an A.C.-D.C. power supply. It uses four new-type, all-metal tubes, and a glass unit as a resistor. The drawing at the left gives construction details for the light, wooden, tapestry-covered cabinet that houses the set

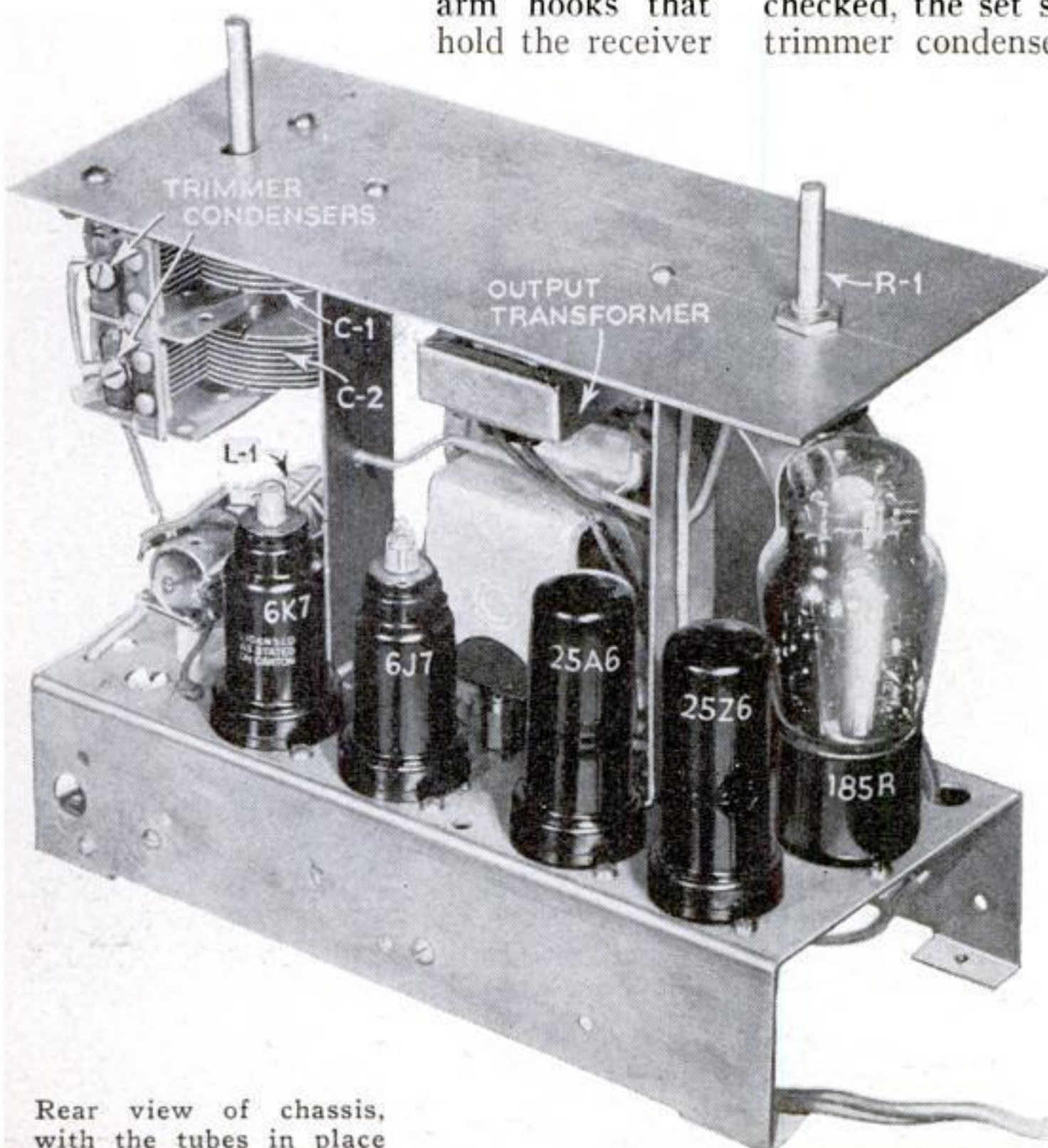
in place on the chair, particular attention must be paid to their length. To provide a substantial support, they should be long enough to extend over the arm and down under the side of the end cushion, as indicated in the illustrations. The weight of the cushion will help hold the receiver firmly in place. Although ordinary sheet aluminum can be used for the hooks, carefully formed strips of spring steel will be stronger and grip the arm of the chair. The hooks are fastened to the back of the receiver with short bolts that extend through the rear face of the cabinet.

When the wiring has been carefully checked, the set should be tested and the trimmer condensers adjusted before the chassis is slipped into the cabinet. This is done by tuning the receiver to the strongest local broadcasting station and turning the adjusting screws on the trimmers first one way and then the other to obtain maximum volume. Repeat the operation on several stations, to insure the best possible balance for all conditions.

If desired, the tone of the set can be altered, within bounds, by placing a fixed condenser between the plate of the detector tube and the chassis, as shown by the dotted line in the circuit diagram. The condenser should have a

value between .0002 and .0005 mfd. Which capacity will operate best can be found only by experiment. Incidentally, the use of this condenser will not only change the tone of the receiver but also will do a great deal toward eliminating bothersome man-made static.

For general operation, an ordinary twenty-five foot A.C.-D.C. antenna will give good results. Although an outside antenna can be used, if desired, under no conditions use a ground. Any connection between chassis and ground will result in blown-out tubes.



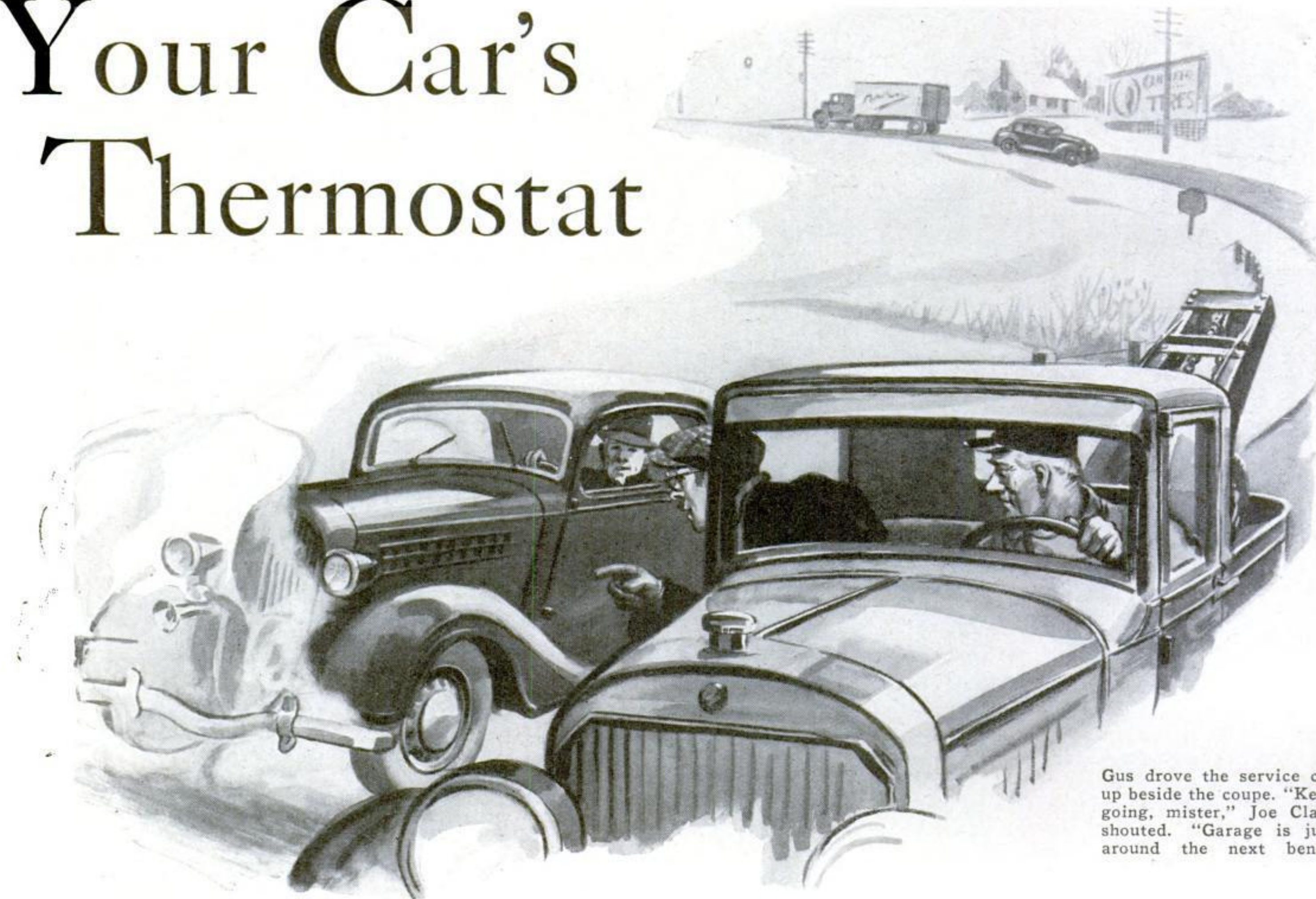
Rear view of chassis, with the tubes in place

LIST OF PARTS

- C₁ and C₂.—Variable condensers, .00036 mfd., ganged.
- C₃.—Fixed condenser, tubular, .01 mfd.
- C₄, C₅, and C₆.—Fixed condensers, tubular, .1 mfd.
- C₇ and C₈.—Electrolytic condensers, 5 mfd.
- C₉.—Fixed condenser, tubular, .02 mfd.
- C₁₀.—Fixed condenser, mica, .0002 mfd., optional.
- C₁₁ and C₁₂.—Electrolytic condensers, 8 mfd.
- C₁₃.—Electrolytic condenser, 16 mfd.
- R₁.—Volume control, 10,000 ohm, with switch.
- R₂.—Fixed resistor, 30,000 ohm, 1/2 watt.
- R₃.—Fixed resistor, 2 megohm, 1/2 watt.
- R₄.—Fixed resistor, 400,000 ohm, 1/2 watt.
- R₅.—Fixed resistor, 600 ohm, 1 watt.
- R₆.—Fixed resistor, 5,000 ohm, 2 watt.
- R₇.—Fixed resistor, 1 megohm, 1/2 watt.
- L₁ and L₂.—Commercial tuning coils, matched, Litz wound.
- Miscellaneous.—Dynamic loudspeaker, metal chassis, upholstery-covered cabinet, four octal midget sockets, one four-prong midget socket, tubes (6K7, 6J7, 25A6, 25Z6, and 185R), antenna wire, knobs, power cord, screws, lugs, solder, etc.

THINGS YOU SHOULD KNOW ABOUT...

Your Car's Thermostat



Gus drove the service car up beside the coupe. "Keep going, mister," Joe Clark shouted. "Garage is just around the next bend"

GUS WILSON halted the Model Garage service car at the intersection of the state road, and then turned onto the concrete stretch behind a fast-traveling coupe.

Joe Clark, Gus's partner in the operation of the garage, who occupied the other seat in the service car, briskly rubbed his ears and pulled his coat more tightly around his throat.

"Dang it, Gus!" he muttered. "I'm just about frozen solid. Hope we don't have any more stalled trucks today. A big cup of hot coffee would hit the spot with me right—er—look at the steam, Gus! Another frozen radiator!"

A heavy cloud of white mist trailed in the frosty air behind the coupe ahead. Evidently the driver had spotted the trouble, for he slowed down and Gus pulled up along side.

"Keep going, mister!" Joe shouted. "Garage is just around the next bend."

The driver nodded his head and dropped back to follow Gus.

"Frozen solid!" the car owner grumbled as he stumbled out of his car in the Model Garage and gazed wrathfully at the hissing column of steam that was rising from under the radiator. "That confounded swindler pinched my antifreeze solution and put in plain water. I've a good notion to go back and knock his block off!"

"How'd he get a chance to do that?" Gus asked, leaning against the car and

By
MARTIN BUNN

waiting for the radiator to stop steaming.

"Garage down the road a piece," the car owner sputtered. "I noticed that the dash thermometer was much too high. Knew it couldn't be freezing, because I'd just had permanent antifreeze put in the day before. Stopped at that swindler's joint and he said the radiator was clogged. He flushed it out this way and that, and hooked me for new hose connections, too. Then he rubbed it in by swiping my antifreeze!"

As soon as the steaming stopped, Gus removed the radiator cap and looked in the opening with the aid of a flashlight. Then he felt the radiator core at various points.

"Humph!" he grunted. "It's a good thing you didn't go back to knock his block off. You'd have busted your fist on a solid-ivory dome. He didn't swipe your antifreeze, and there wasn't anything the matter with the radiator in the first place. The thermostat is busted, that's all."

"Thermostat busted!" echoed the car owner. "How could that happen?"

"Just a minute and I'll show you," said Gus, as he shoved a pan under the radiator and started it draining. When the level of solution in the radiator had dropped far enough, he removed the upper hose connection and took out the thermostat.

"Here you are," he said, pointing to a spot on the copper bellows of the thermostat with a huge, work-stained finger. "See where the copper has corroded right through?"

"I see it," the car owner admitted, "but what's a little hole like that got to do with it? The rest of the copper is all right, isn't it? You don't mean to say that a little hole weakens the copper so much that it can't expand like it should?"

"You've got the cart before the horse, mister," Gus laughed. "All that this copper is supposed to do is to resist expansion. The expansion is produced by what is supposed to be inside—only it isn't, because it leaked away through the hole."

"What is supposed to be inside?" asked the car owner. "Is it a liquid, or a gas, or what?"

"Each maker has his own ideas on that," Gus replied, "and of course it depends on the temperature at which the bellows is supposed to expand. For instance, if you wanted a thermostat that would open at, say, around 180 degrees, you could put a little ordinary alcohol inside before you sealed up the bellows. Then, when the bellows reached the boiling point of alcohol, the pressure would go right up and the bellows would expand. Or, if you put in a little water, the bellows would expand as soon as the temperature reached 212 degrees."

Joe Clark came out of the stock room with a new thermostat in his hand. "This is the same size and temperature rating," he said, as he *(Continued on page 130)*

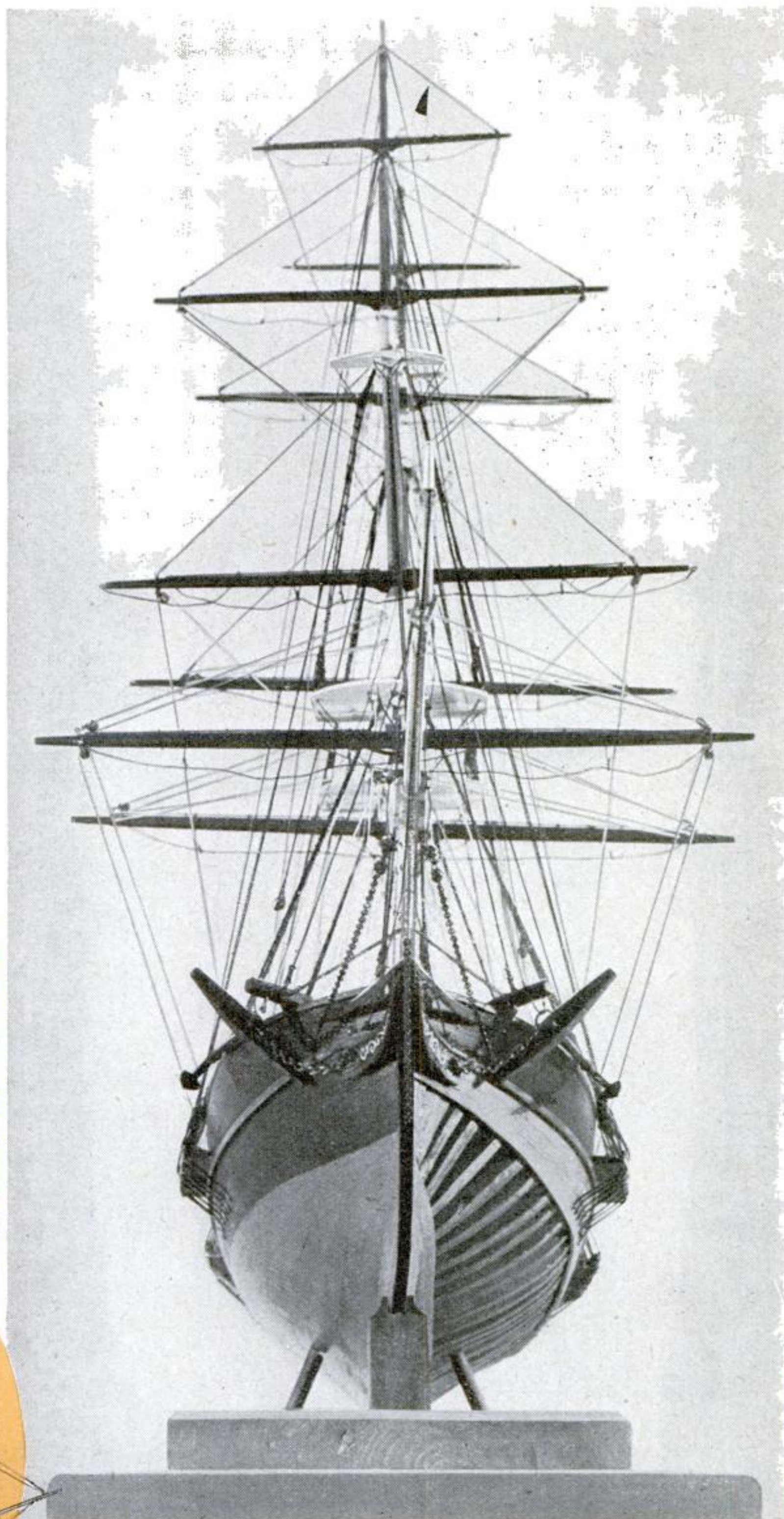
THE HOME WORKSHOP

A NEW BRIG Model

*Built with Frames and
Planking Just Like
a Real Ship*

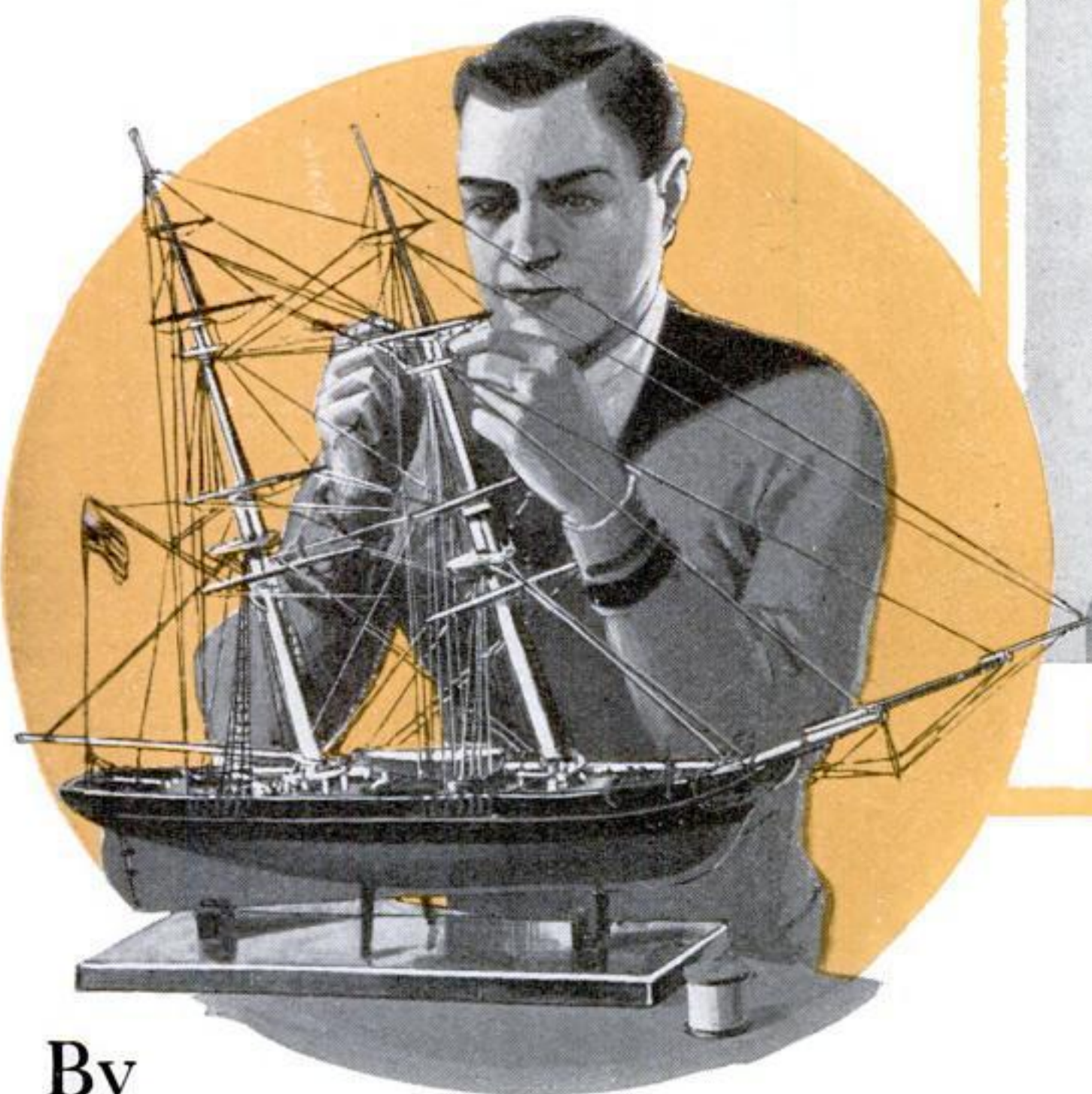
CONSTRUCTED from the keel up like a full-size wooden vessel, our latest model is different from all the others we have described since POPULAR SCIENCE MONTHLY set out to popularize the ship model making hobby eleven years ago. Heretofore the hulls of our models have been of the solid or layer-built type, not made with frames or ribs and inclosed with planks.

As illustrated in the photographs, the hull of the new model—a brig—is completely planked and painted on one side, but only partly planked on the other, with the wood left the natural color to show the interior construction. The deck is completely planked, although one could leave part of the deck and both sides open, or plank the whole ship.



This striking dry-dock view of the model shows the principal feature of its construction—a hull consisting of frames covered with wooden planks

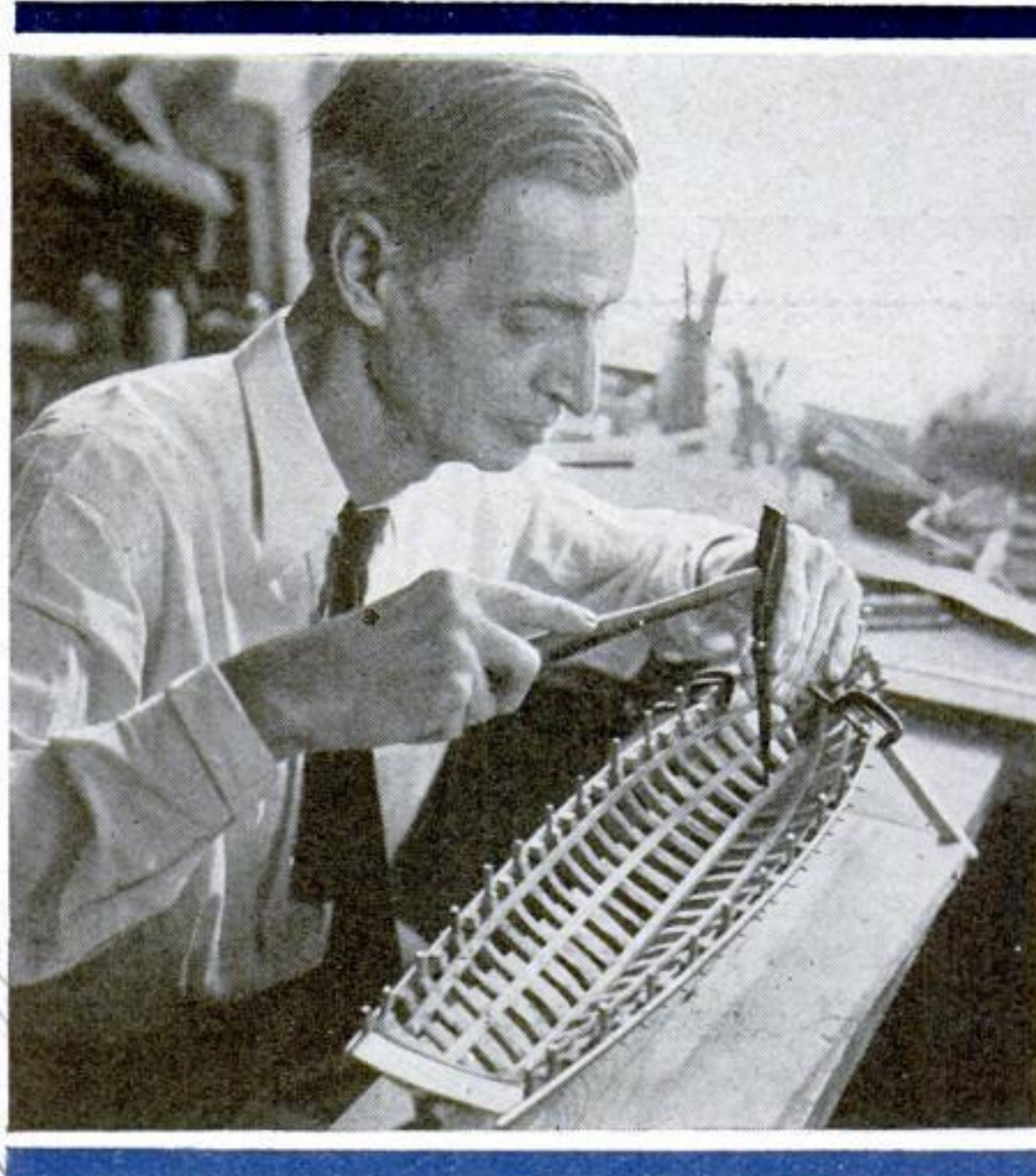
Now there will be the merry sound of sawing, planing, and hammering in thousands of little shipyards tucked away in basement and attic workshops. That always happens when we announce a new model. And this model is especially noteworthy because it is made by the framed-and-planked method . . . because it is a picturesque two-masted square-rigged ship . . . and because it is built on a comparatively large scale, which makes the work easier.



By
CAPT. E. ARMITAGE McCANN



Captain McCann nails down the keelson inside the framework. The model itself has a hull 20 in. long. It is 33 in. long by 22 in. high over all



were usually made of pear wood.

The keel is a strip of wood $7/32$ by $3/8$ by 18 in. On either side $1/4$ in. from the bottom, cut a V-shaped rabbet, a scant $1/16$ in. deep, to take the edge of the garboard strake (lowest plank). As the strake will lie in this at varying angles, some care is necessary in cutting the angles of the rabbets.

The stem is the same thickness as the keel, tapering to the front edge. It has rabbets on either side for the plank ends. Inside the stem, on a real vessel, are a number of pieces to give it more width and depth. All these I represented by making the stem quite wide. It overlaps the

keel, to which it is fastened as shown with what is known as a scarf joint. Cut an elongated hole in the stem as shown for the gammoning. (Readers who are not familiar with nautical terms can find the definitions in any unabridged dictionary, often accompanied by informative illustrations.)

I made the sternpost and deadwood in two pieces, one vertical and the other horizontal, joined at about line 28. These parts need rabbets for the garboard and the plank ends to fit into. Do not as yet cut off the extending piece of keel.

Stem, keel, and stern pieces are glued and screwed together while lying flat on a board, to insure their being all on one plane, with no twist. Along both sides of the keel and across the top, mark the position of the frames *T* to 30. The sheer plan shows the position of the middle of each frame.

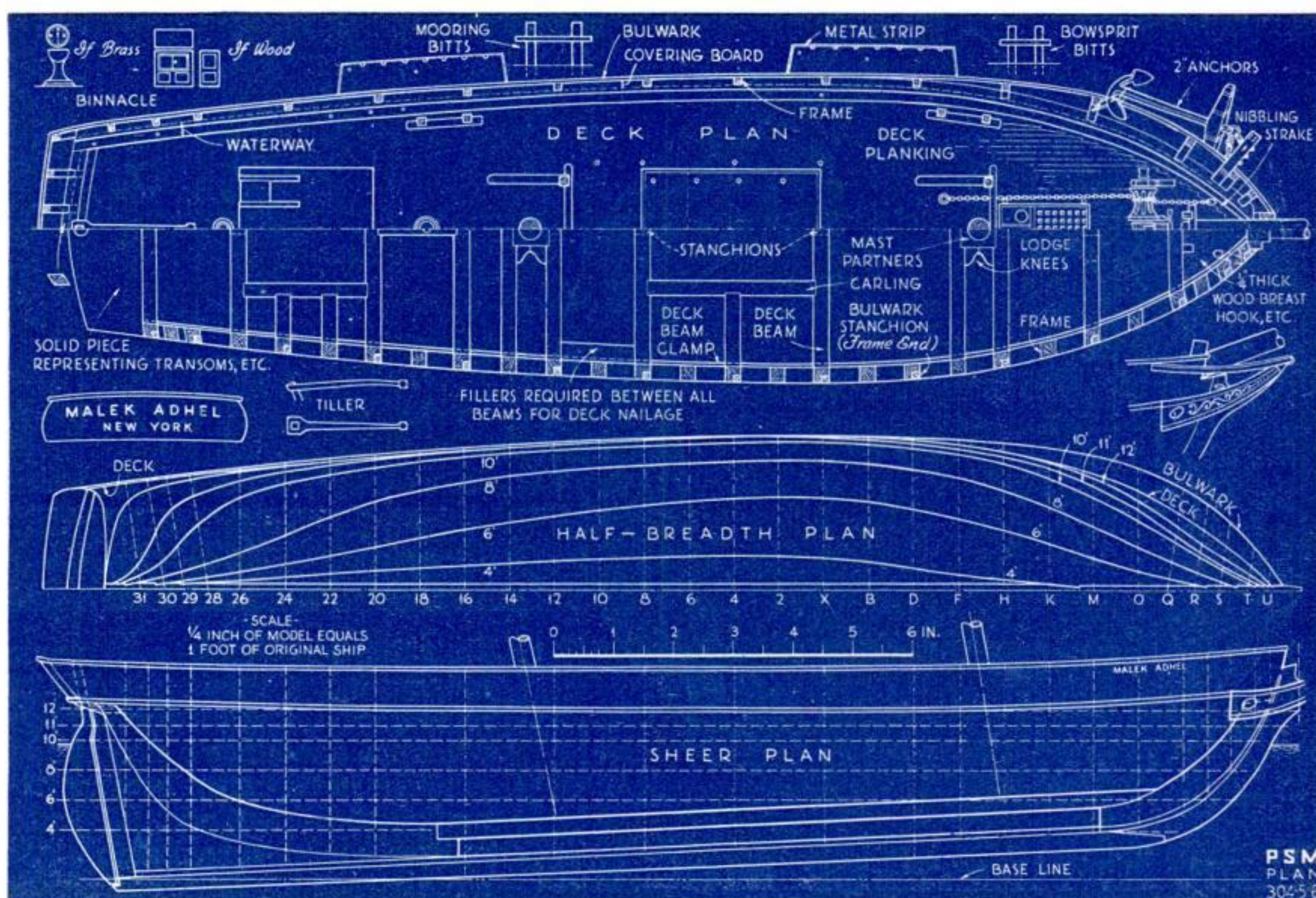
To erect the frames, a building board

Those who prefer to stick to the old, familiar, and easier "bread-and-butter" system of construction may use the same drawings and make the hull from boards, sawed to the correct outline, then glued together and carved to agree with the accompanying body plan. As the lines of the plans as drawn give the size inside the planks, $1/16$ in. should be added to them all if one wishes to be quite correct in making a solid hull. A series of water lines should be drawn on a full-sized layout on the sheer plan and spaced as far apart as the thickness of the boards to be used. These lines are then carried across the body plan and from there stepped off with dividers to the half-breadth plan, thus giving the size and shape to which to cut the various lifts or layers.

When considering which vessel would best suit our purpose, I found William H. Webb's own lines and sail plan, but no deck plan, for the brig *Malek Adhel*. She was built for the Pacific trade

in 1840. Her dimensions were: length, 80 ft. on deck; molded beam, 20 ft. 7 in.; depth of hold, 7 ft. 9 in.; tonnage, 125 tons. On a scale of $1/4$ in. equals 1 ft., these dimensions give a hull 20 by $5\frac{1}{8}$ in., and when rigged the model measures overall

33 in. long by 22 in. high. We thus have an easy scale but not too large a model. A further advantage is that the brig rig, while picturesque, is comparatively simple. For wood, I used $1/4$ -, $1/8$ -, and $1/16$ -in. gumwood, except for the deck, and found it quite satisfactory, but other woods such as cedar and poplar (whitewood) would do as well. The British Admiralty models



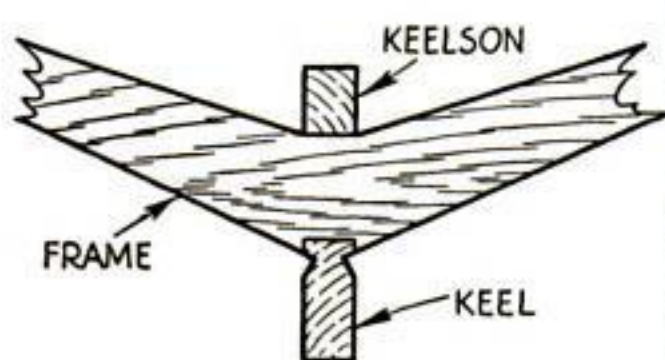
Here are the drawings you need for constructing the hull, with a scale in inches for finding all necessary dimensions. By using the same sheer plan and body plan, you can construct a solid hull if you prefer

is needed, equivalent to the building ways of the shipyard. This I made from a board 1 by 8 by 20 in. On this I nailed, edge up, a strip 1 in. thick, 24 in. long, and tapering from 2 in. at the forward end to only $\frac{3}{4}$ in. at the other. The taper is necessary to bring the water lines horizontal. Some side and end battens are nailed to the strip to hold the keel tightly along the center. A nail through the extended keel, aft, will help. Cut two bars to go diagonally from high up on the stem and stern to the ends of the board, to shore the framework truly upright, that is at a right angle to the base-board.

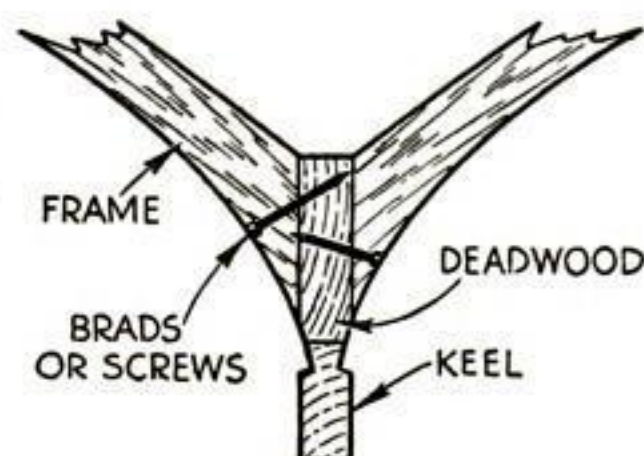
Most of the frames are shown on the body plan, which gives the width at the middle of each. The sheer plan shows the vertical position of the center line of each. The original vessel had fifty frames. The half-breadth plan shows every other frame, except at the ends where they are closer, and that is all the frames I gave my hull, but you can put another frame between each pair shown, if you wish. I made the frames $\frac{1}{4}$ in. wide. In depth they taper from about $\frac{5}{16}$ to $\frac{1}{4}$ in.

A whole frame in a real ship is built up of seven half-thickness pieces called "futtocks," spiked together so that the grain of the wood is always lengthwise of the frame. That is a lot of work to do on a model, so I compromised by gluing together two $\frac{1}{8}$ -in. thick pieces of wood with the grain crossing and from this jigsawed the midship frames, each in one piece. This gives plenty of strength and about the same appearance. Some might prefer to use $\frac{1}{4}$ -in. three-ply wood.

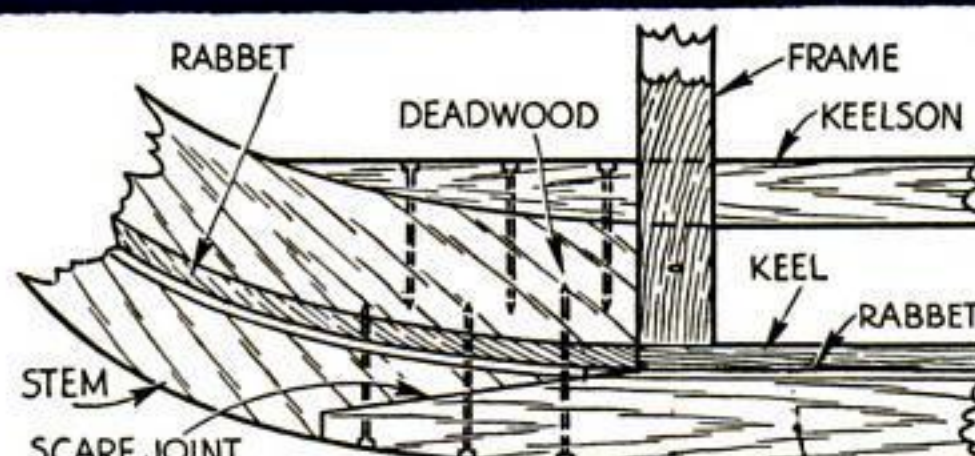
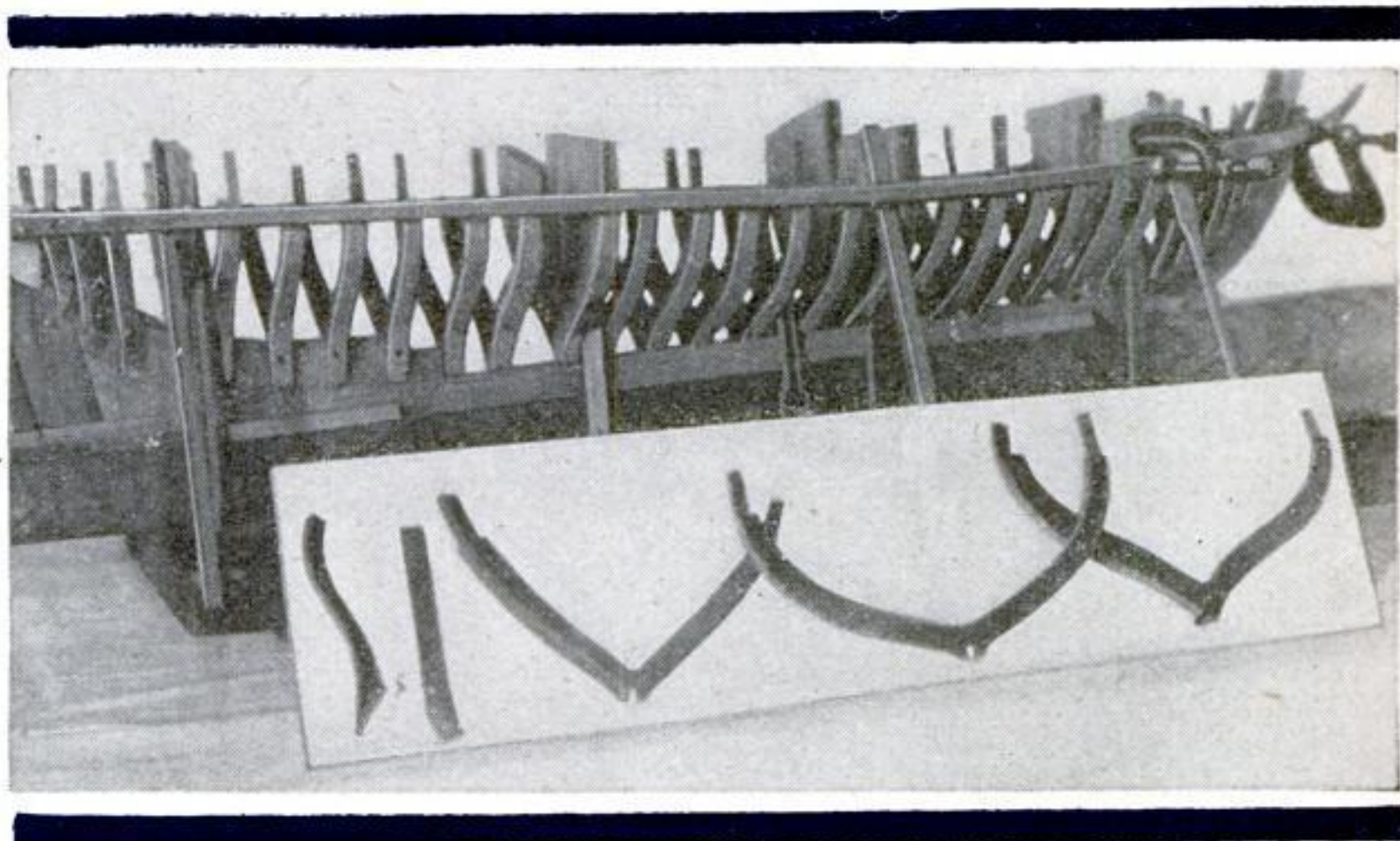
The hull with all frames up except where the molds are in position. A temporary batten shows the deck line. The frames yet to be placed are seen in the foreground



Whole Frame in Section



Half Frame in Section



Forefoot in Profile

Sketches of construction at keel. One shows the lower part of a typical whole frame in relation to the keel and keelson; another, a half frame at the bow; and a third makes clear the method of joining keel and stem to keelson and deadwood

As stated, the body plan gives the greatest width of the frames at their middle line, but this will not serve for cutting, because, due to the curves of the hull, the forward frames will be wider than this at their after edges, and the after frames at their forward edges. This angle at any station can be seen on the breadth plan, where a construction line crosses a water line. For the convenience of readers, this has been worked out, and the greatest beam, or cutting line, for each frame is given on the plan.

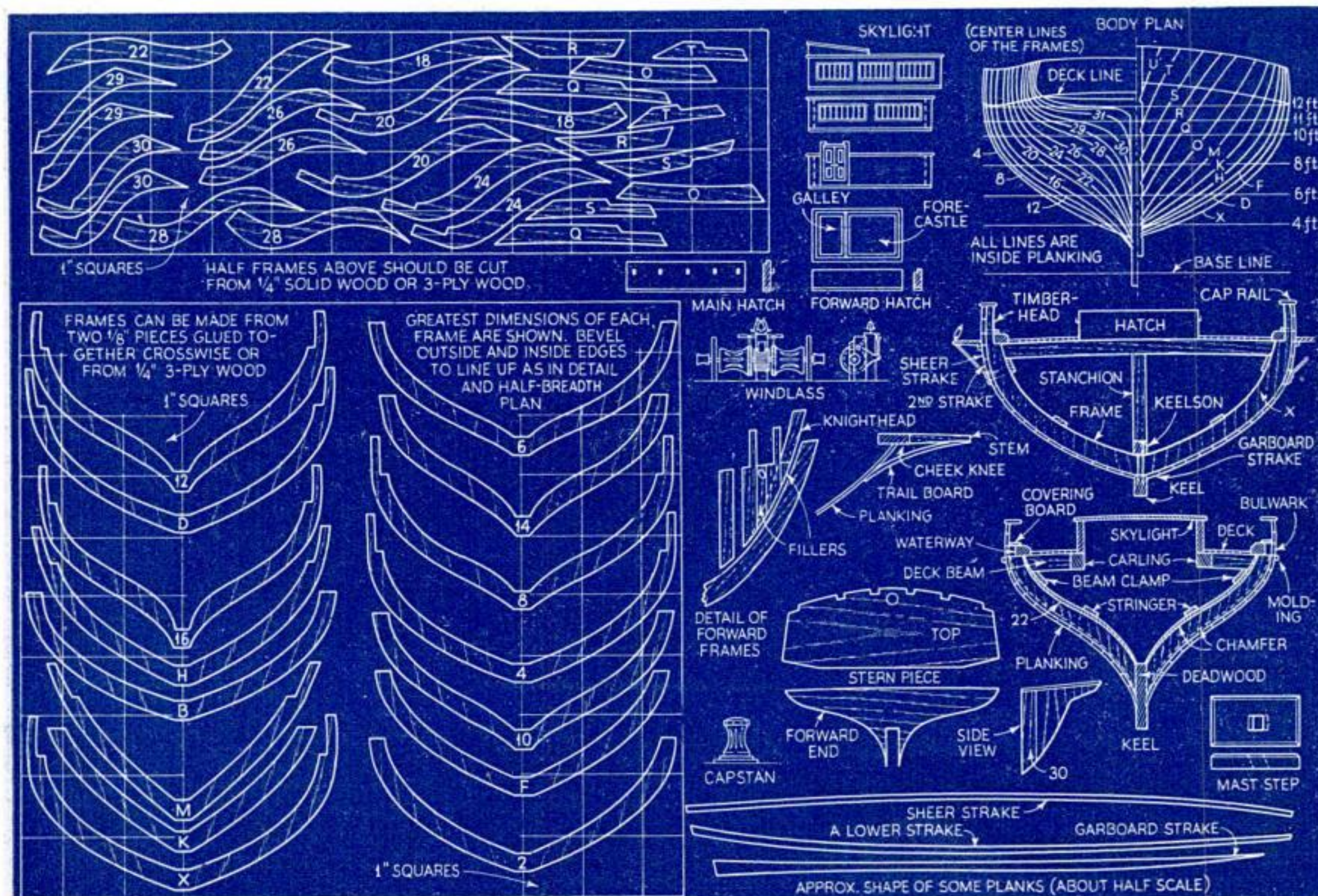
From *M* to 16 the frames are in one piece, rail to rail, resting on the keel. Those forward and aft of these are in two pieces, screwed or nailed to the deadwood. The latter frames are just as well or better if made from solid $\frac{1}{4}$ -in. wood.

The end frames 28, 29, 30 and *Q*, *R*, *S*, *T* are called "cant" frames because they are set at an angle to the deadwood, to be at about a right angle to the outside planking; so that their edges do not need so much beveling. The lines on the sheer plan show the top of the deadwood and the various positions of the lower edges of the half frames.

While not essential, it is a good idea to use some solid temporary templates to get the heights right and to steady the battens until the ribs are shaped and placed evenly. With vertical battens nailed to the building block, I fixed templates at *M*, *X*, 8 and 16. These templates I cut according to the body plan, and set them up with their vertical edges at the construction lines on the keel, except the middle one (*X*), which stands centrally on its construction line. At the exact deck level height I nailed a stiff batten on either side from *M* to the stern.

Erect the frames between the templates temporarily, making sure that they are vertical and at a right angle to the keel. Nail them lightly to the keel and side battens. With a batten laid from template to template, mark the amount of bevel at various heights. Remove each frame and cut this bevel, outside and inside. Most of this work can be done on a motor-driven sander if you have one, otherwise a sharp penknife and a large half-round file are the best tools. Replace the frames and nail them to the keel.

The side battens will not take the right shape for the ends of the forward frames, so I made



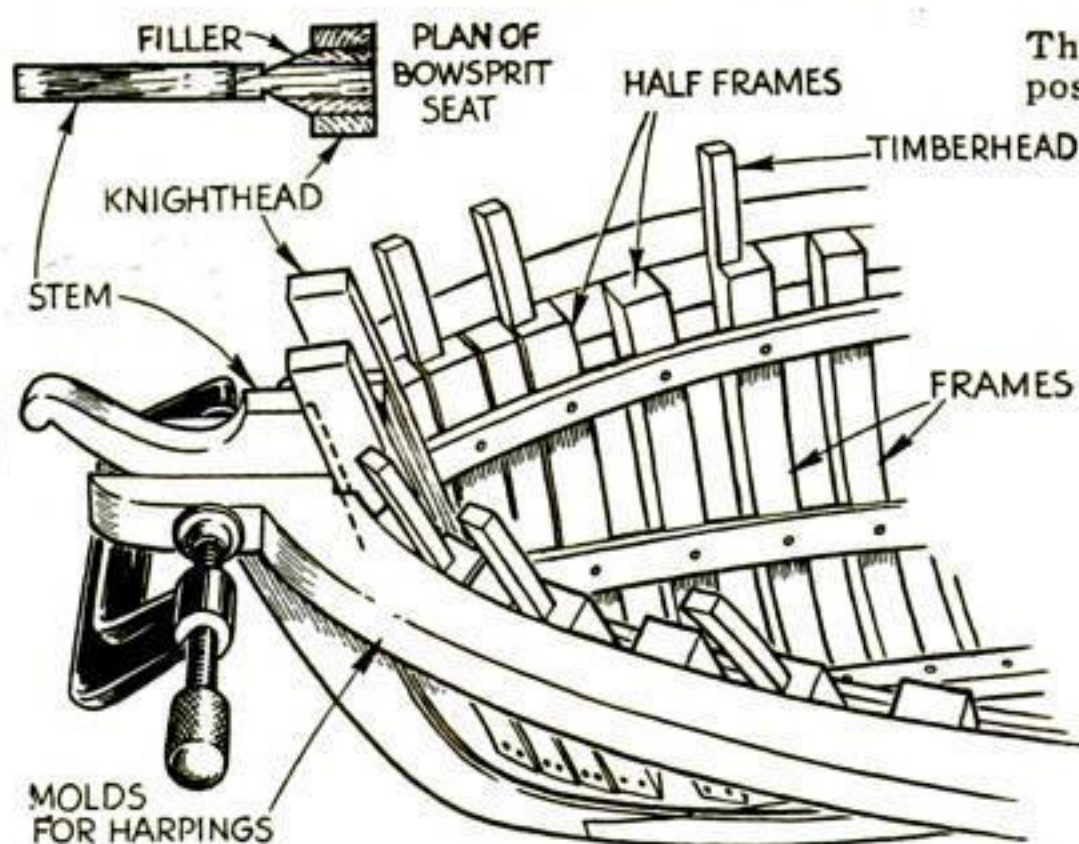
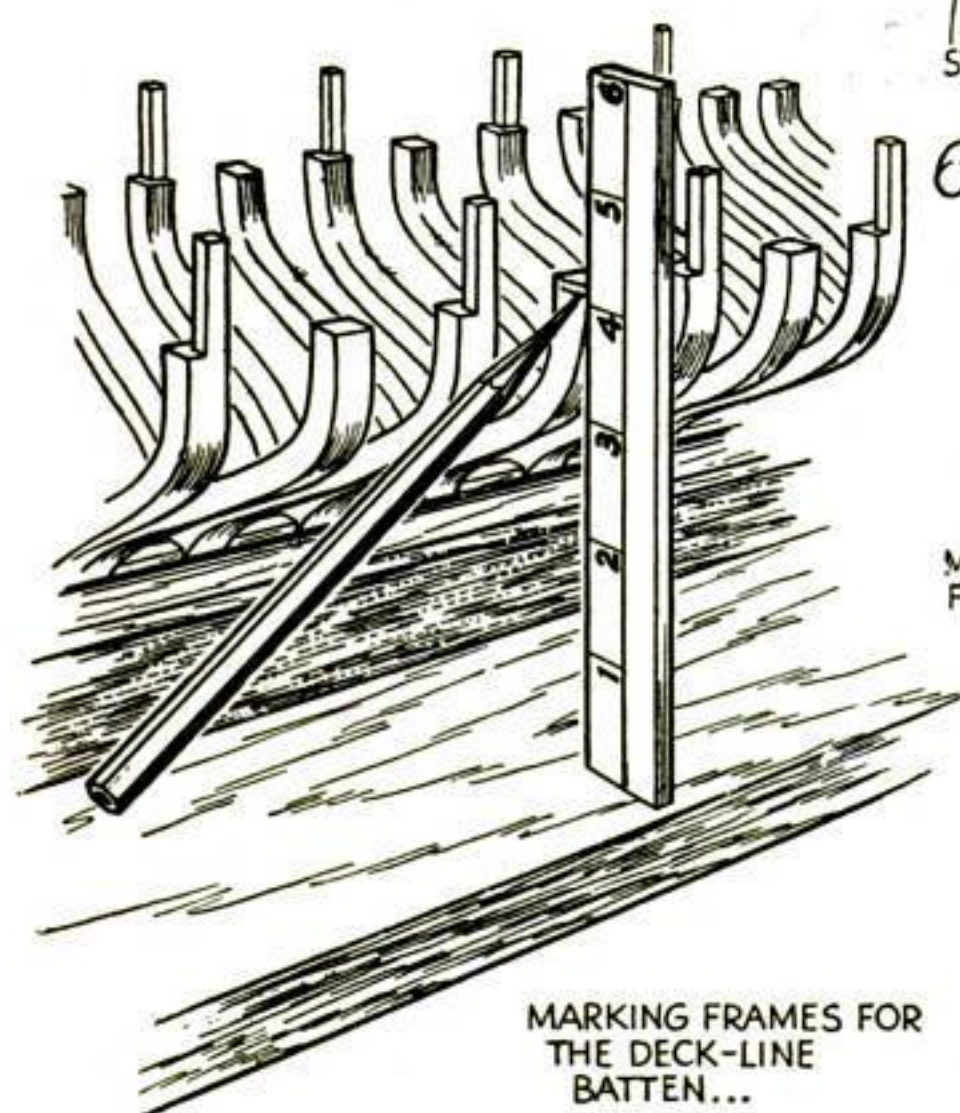
what shipwrights call "harpings." They are pieces of plywood cut to the shape of the deck from the half-breadth plan and extending from the stem to the first frame template. At the forward ends I left lugs to clamp to the stem at the right height, and the after ends have notches to fit over the ends of the side battens and be nailed to the templates.

It is awkward to have to set up the half frames temporarily, so they can be beveled by measurement from the half-breadth plan and firmly glued and screwed or nailed in position. Use $\frac{1}{4}$ -in. No. 0 and $\frac{3}{8}$ -in. No. 0 screws.

One cannot get the stern contours quite right until the counter has been built up. The counter is really made of a number of cross transoms and other timbers, but they are so close to each other as to form almost a solid piece. It is therefore easier to shape a block of soft wood to fill in from the last upright frame (30) to the taffrail. This piece is difficult to describe or draw. The top continues the deck contour. There is a vertical slot in the middle to fit on the sternpost, above which it rises to the level of the underside of the deck. It extends aft to the knuckle between the upper and lower counters. The front edge butts against frame 30 and follows its contour down. The lower edge follows the line of the lower ends of the frames. The after edge is the shape of the lower counter. Between the deck and lower edges, at the sides, the contours follow those of the frames. It is best to make this piece a bit large and file it to shape. The deck-line batten will be nailed to this.

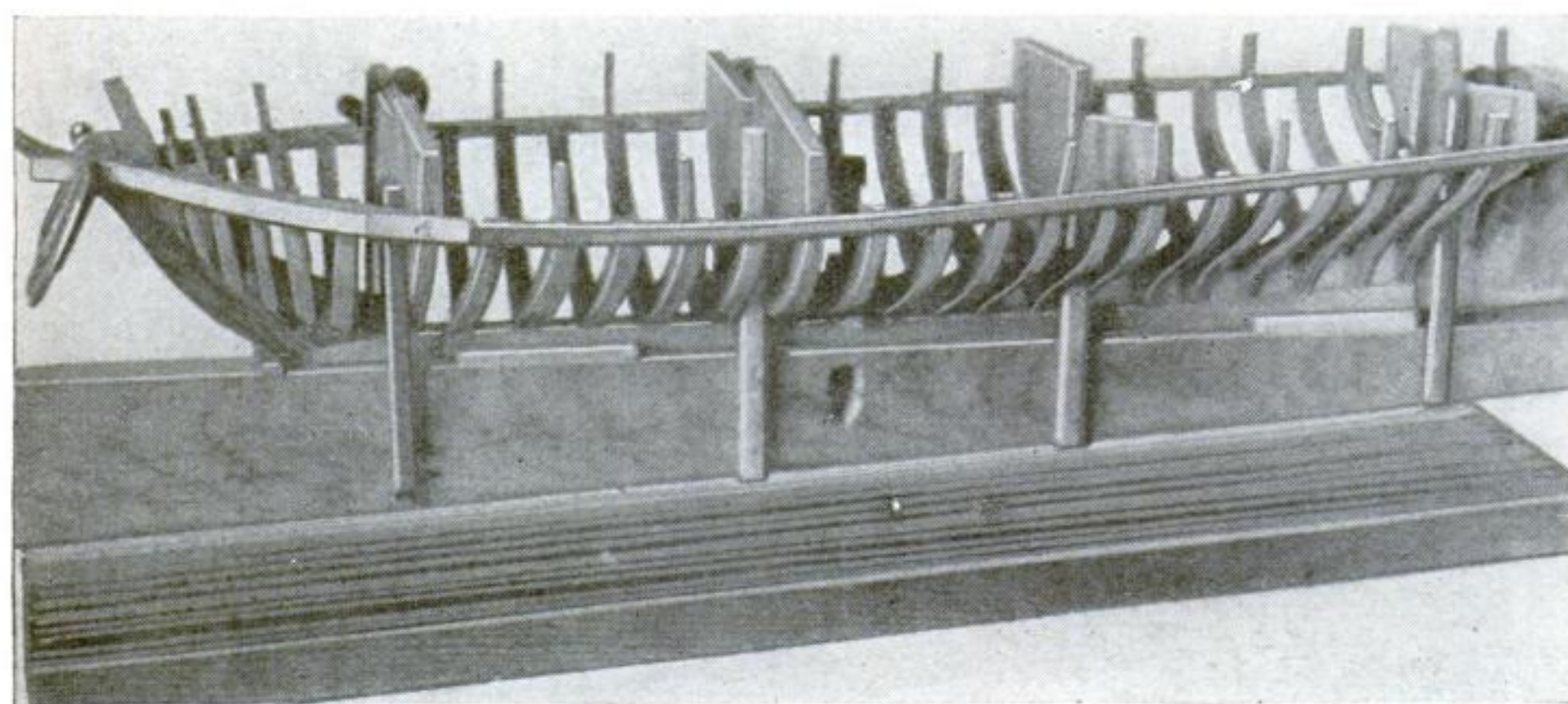
If two-ply frames are used, let the vertical grain face forward so the projecting $\frac{1}{8}$ -in. square timberheads will be strong enough. If plywood is used, it is better to have the grain of the core vertical and cut the timberheads from it, keeping them central.

On either side of the stem proper, filling pieces are needed to bring it to the bowsprit diameter ($\frac{3}{8}$ in.).

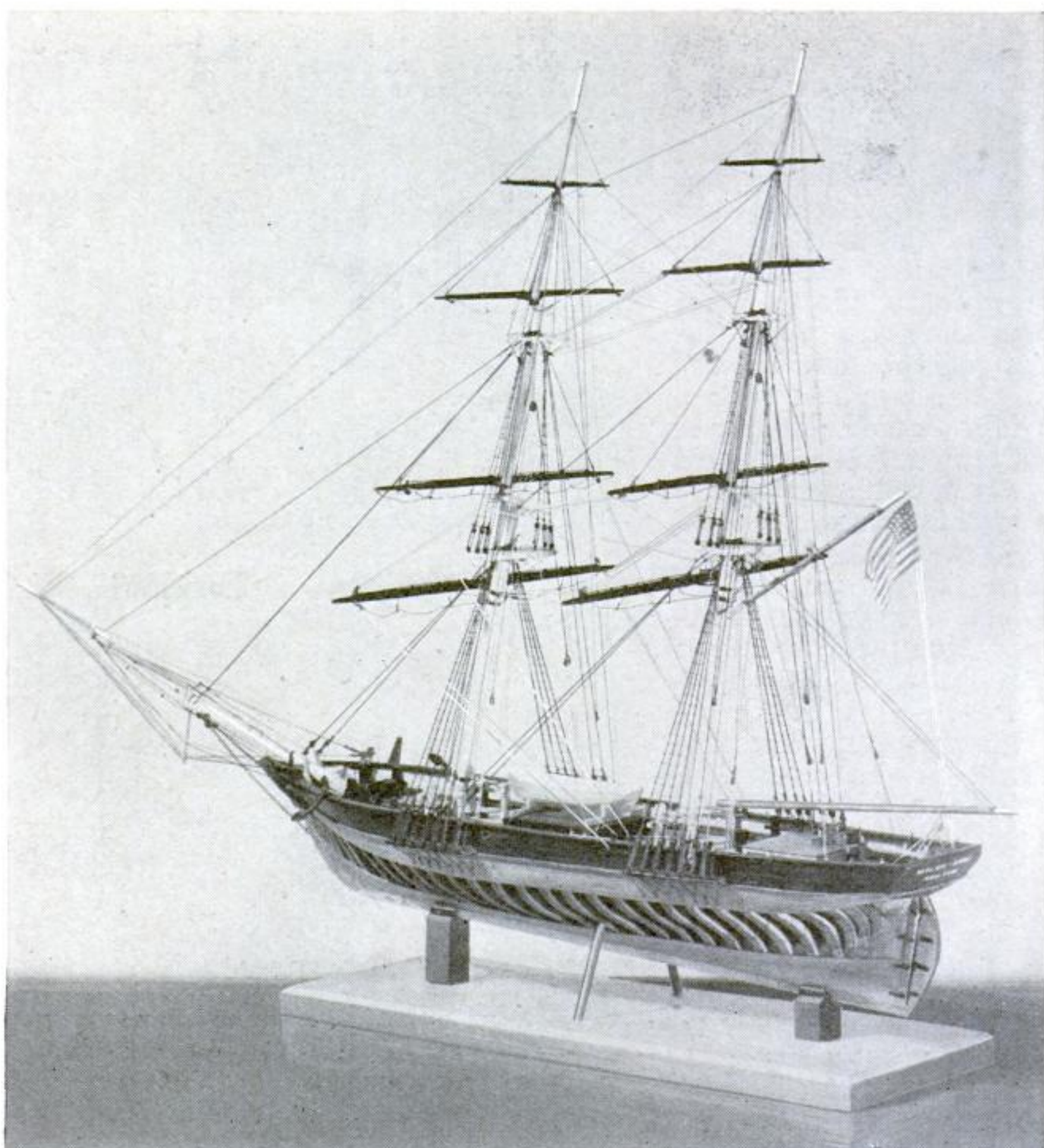


These extend down until they meet the rabbet line. Outside of these are the knightheads ($\frac{5}{32}$ by $\frac{1}{4}$ in.), which are nailed to the stem and extend down to the rabbet line, their lower ends being beveled to conform with the plank lines. The space between S and T is filled in solid.

(TO BE CONTINUED)



Another view of the hull framework with the molds still in position. Note particularly the temporary pieces for keeping the bow frames in line; these are also shown in a sketch above



The model seen from the side where the hull was purposely left partly unplanked. Left: Bow construction

List of Materials

GUMWOOD OR SEMIHARD WOOD

No. of Pcs.	Dimensions	For
1 $\frac{1}{4}$ "	x 4"x12 $\frac{1}{2}$ "	Half frames
2 $\frac{1}{8}$ "	x11"x11"	Frames
1 $\frac{1}{4}$ "	x 6"x20"	Keels, waterways, etc.
1 $\frac{1}{8}$ "	x 3"x21"	Stringers, etc.
2 1/16"	x 8"x20"	Planking (both sides)

Note: In place of the $\frac{1}{8}$ " stock listed for the frames, $\frac{1}{4}$ " three-ply wood may be used.

SOFT PINE

1 1 $\frac{1}{4}$ "	x1 $\frac{1}{4}$ "x3 $\frac{3}{4}$ "	Counter piece
1 1"	x1" x1 $\frac{1}{4}$ "	Boat

LIGHT-COLORED WOOD

1 1/16"	x4 $\frac{1}{2}$ "x20"	Deck
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HARDWOOD

1 3"x $\frac{5}{8}$ "	round	Windlass and capstan
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MISCELLANEOUS

Dowel sticks, $\frac{3}{8}$ "x7", 5/16"x26", $\frac{1}{4}$ "x36", 3/16"x24", $\frac{1}{8}$ "x26"
 Fiber board, 3/32"x1"x2 $\frac{3}{4}$ " for caps.
 Deadeyes—3/16", 54; $\frac{1}{8}$ ", 32.
 Blocks— $\frac{1}{4}$ ", 4 single, 1 double; 3/16", 20 single, 2 double; 5/32", 17 single, 5 double; $\frac{1}{8}$ ", 7 single, 6 double.
 Belaying pins— $\frac{3}{8}$ ", 40.
 16 thimbles and 8 hearts.
 Rigging line:

	Diameter (inches)			
	.04	.03	.02	.01
Black (feet)	26	24	14	44
Brown "	—	18	22	10
Soft wire—No. 18, 4"; No. 20, 36"; No. 24, 20"; No. 30, 60".				
Covered or black wire, 70" for footropes.				
Chain—10- or 12-link, 30"; 18-link, 24".				
Thin sheet brass, 1"x4". Spool No. 70 mercerized cotton. 2 anchors 2" long. Bell, $\frac{1}{4}$ ". Flag.				
$\frac{1}{2}$ " pins, $\frac{3}{8}$ " brads, $\frac{1}{2}$ " and $\frac{3}{4}$ " thin wire nails, $\frac{3}{8}$ " screws.				
Paint—white, black, with red and blue or other colors; varnish. Glue.				
Base—1 piece $\frac{3}{4}$ "x6"x18"; 1 piece $\frac{3}{4}$ "x $\frac{3}{4}$ "x3 $\frac{1}{4}$ "; 1 dowel stick $\frac{1}{4}$ "x8".				



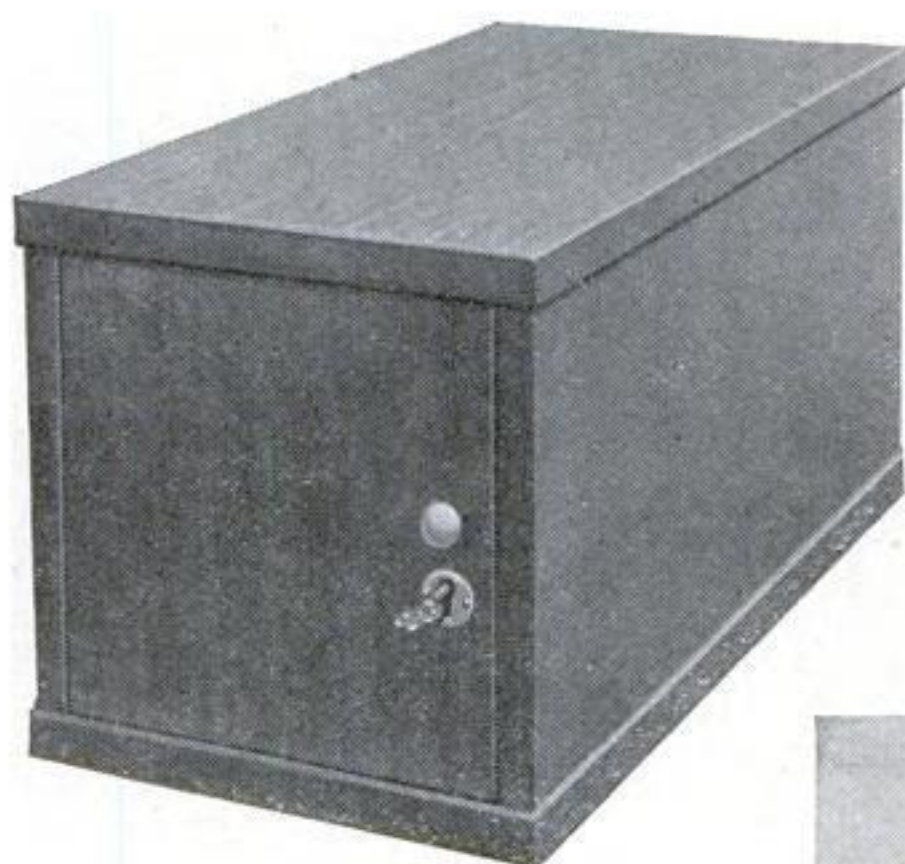
Closed, the cabinet is of neat and unobtrusive finish. It is made of mahogany with a slight projection of the top and bottom on three sides. The hinges are of the so-called "invisible" type, and a small brass knob and lock are provided

Microscope Slides Filed Away Flat

IN FINE HOMEMADE CABINET

This method prevents the balsam mounts from slipping as they may do when stored vertically, and it saves keeping a special index

By
CHESTER F. PROTHERO



EVERY microscopist who uses the conventional type of box or cabinet for filing his slides knows how warm weather or heat from a nearby radiator is likely to cause thick balsam mounts and their contents to coast stickily down toward the bottom of the glass. The remedy is to file slides horizontally, but suitable commercial cabinets are almost prohibitive in price.

The cabinet illustrated was constructed at a cost for materials of less than seven dollars, and it could be made considerably cheaper. Besides solving the problem of the sliding balsam mount, it makes filing systems unnecessary, as merely pulling out a drawer exposes the face of every slide, together with its label.

In constructing the cabinet, you can use any variety of hardwood such as mahogany. The drawer fronts are made from the same wood, as are the drawer slides. The drawer bottoms are of $\frac{1}{8}$ -in. pressed composition wood, and the partitions are of any straight-grained softwood.

Cabinet. Cut the top, bottom, and two sides, the grain running from front to back. Use $\frac{7}{8}$ - or 1-in. rough stock and plane it down to $\frac{3}{4}$ in. Top and bottom are $9\frac{1}{8}$ by $18\frac{1}{2}$ in.; sides, $7\frac{1}{2}$ by $18\frac{3}{8}$ in. For a neater job, let the top and bottom extend $\frac{1}{8}$ in. beyond the door and side panels at the front and sides, leaving the back flush. Also cut the top, bottom, and sides $\frac{3}{8}$ in. shorter than the lengths given, and glue and nail strips of wood $\frac{3}{16}$ in. thick to both ends of each. In this way the end grain is concealed. Throughout the whole job, countersink all nails and fill the holes with mahogany-colored wood composition.

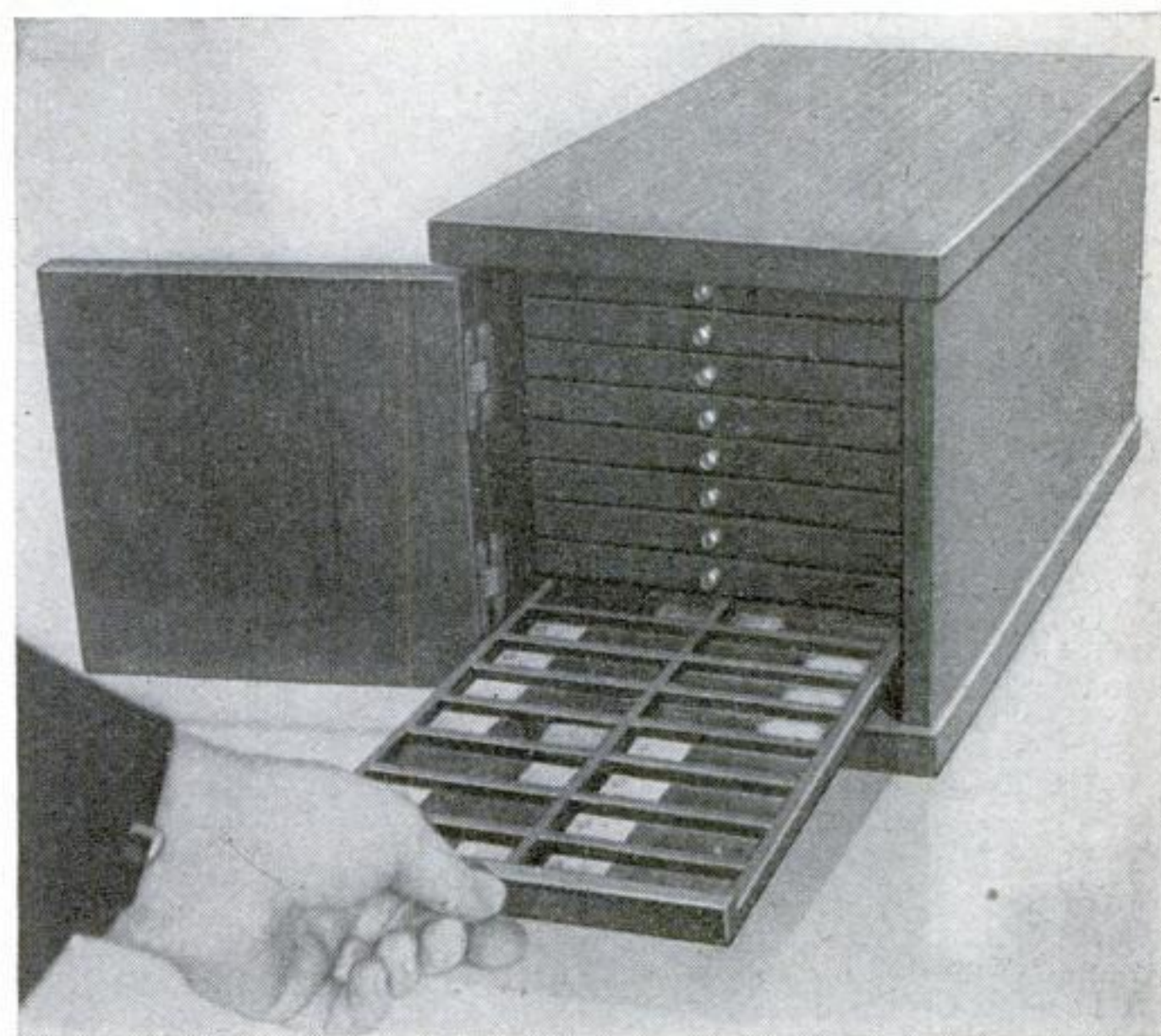
As the top will be attached to the sides and back by 1-in. angle irons, mortise out the top and sides (on the inside) about $5\frac{1}{4}$ in. in from the front and back so the irons will be sunk flush with the surface.

Chisel mortises in the side for small brass hinges. If you prefer to use invisible

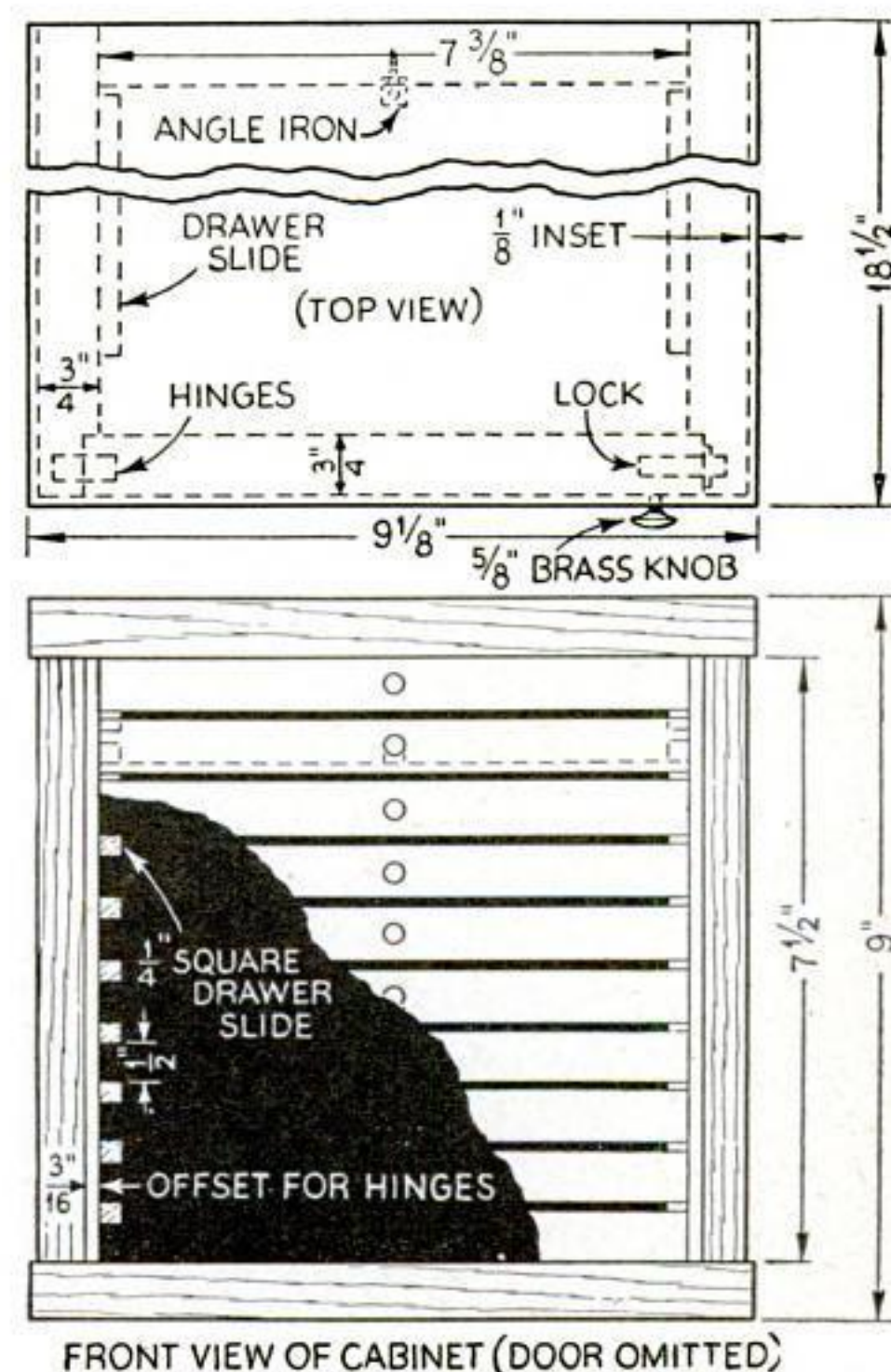
hinges, as the author did, it will be necessary to rabbet out the side panels to a depth of $\frac{3}{16}$ in. and the thickness of the door. This allows the drawers to slide freely past the internal hinge of the invisible fixture when the door is swung open. Then, to balance the appearance of the front, the lock slide also should be chiseled to the same depth and thickness. Using brace and bit and chisel, next cut the mortises necessary to sink these special hinges into the sides.

For the ten-drawer cabinet described, cut eighteen strips of wood and plane them to $\frac{1}{4}$ by $\frac{1}{4}$ by $15\frac{3}{4}$ in. for drawer slides. To insure accurate fitting, also cut a guide piece or spacer of pine $\frac{1}{2}$ in. wide by 15 in. or more long. Drill the drawer slides at four places along their length for nails before installing them. Place one edge of the guide piece flush with the bottom edge of the side panel. Brush glue on one face of a drawer slide, set it firmly against the guide piece, and nail it fast with $\frac{1}{2}$ -in. nails. Be sure the front end of the slide is $1\frac{3}{4}$ in. in from the front edge of the side panel. Install only nine drawer slides on each side panel, as the bottom drawer slides on the cabinet bottom.

Now assemble the top and sides with the angle irons, using $\frac{3}{8}$ -in. flatheaded screws. Attach the bottom with six $1\frac{1}{2}$ -in. screws, countersunk in $\frac{3}{8}$ -in. holes, which are later *(Continued on page 121)*



There are ten flat drawers, each subdivided to contain twenty-four slides, the labels of which can easily be read without handling or disturbing them



Blocked and clamped in this way, a pair of skis will not warp

How to Put Away Your Skis

IF YOU are one of the countless thousands who took up skiing for the first time this winter, you probably want to know what to do with your skis in order to keep them in good shape for next season's sport. It is simple enough—just a matter of preserving the curves and preventing warping.

The first step is to soak the old wax with gasoline or benzine and scrape it off the running surfaces. The scraping may be done with an old plane iron, a straight piece of tin, the back of a knife, or any similar tool that is not too sharp. Be sure to clean out the grooves thoroughly. If the skis have had hard usage, sandpaper the running surfaces lightly to smooth any small nicks or cuts.

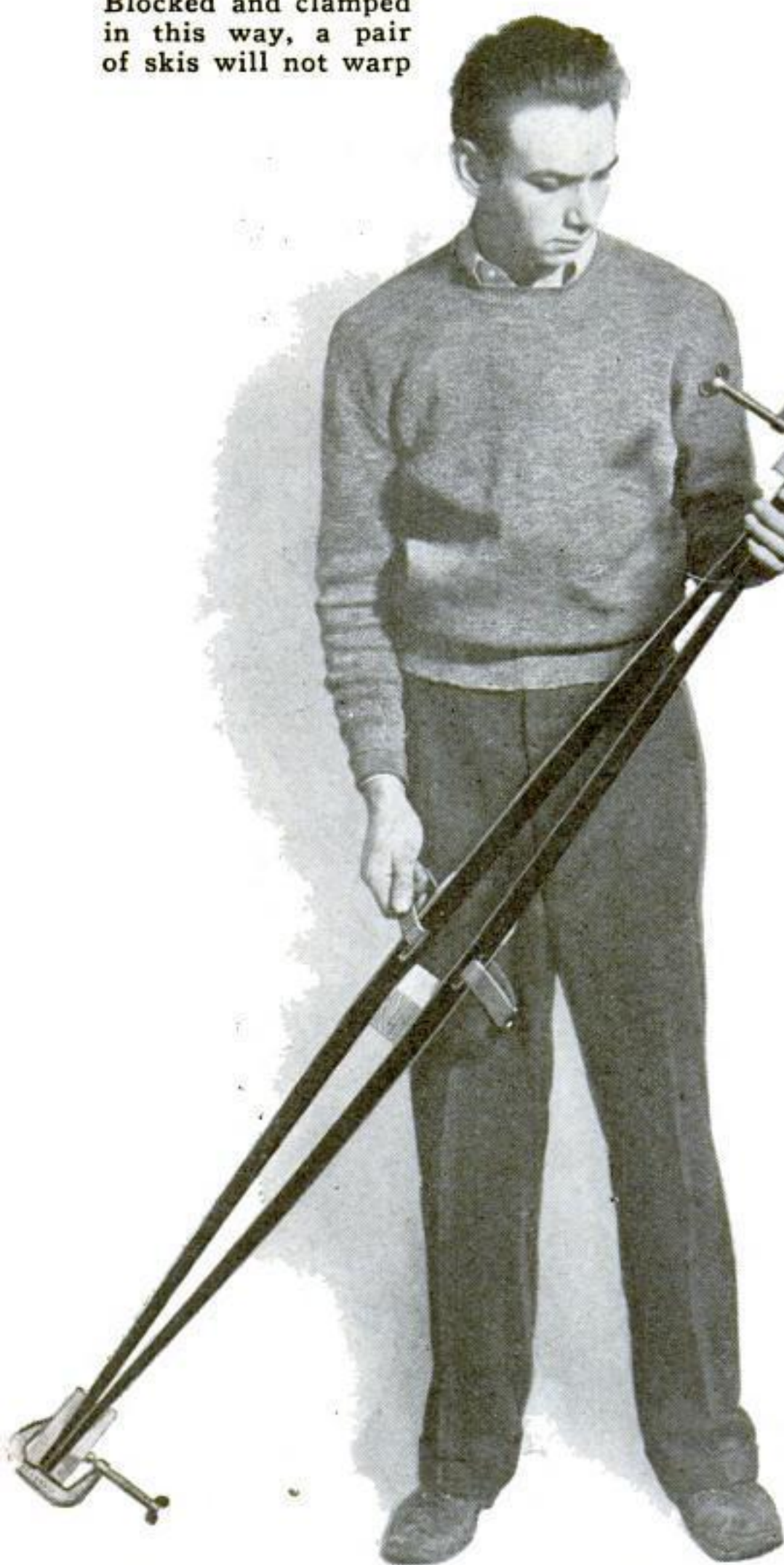
Many sportsmen waterproof new skis by soaking them in raw linseed oil several times until the wood will absorb no more. If this has been done, it is not necessary to oil the skis further; otherwise, rub oil on at this time. A mixture of four fifths linseed oil and one fifth paraffin is sometimes recommended instead of straight oil.

Massage neatsfoot oil into the leather fittings, and your ski boots as well, but wait until they are thoroughly dry.

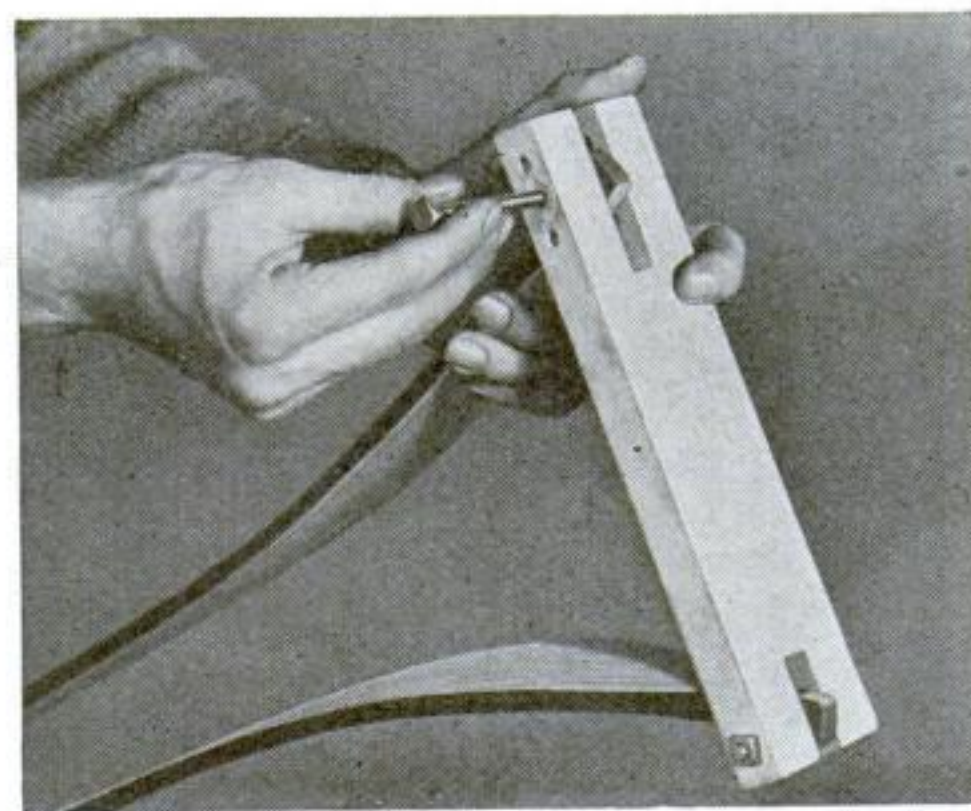
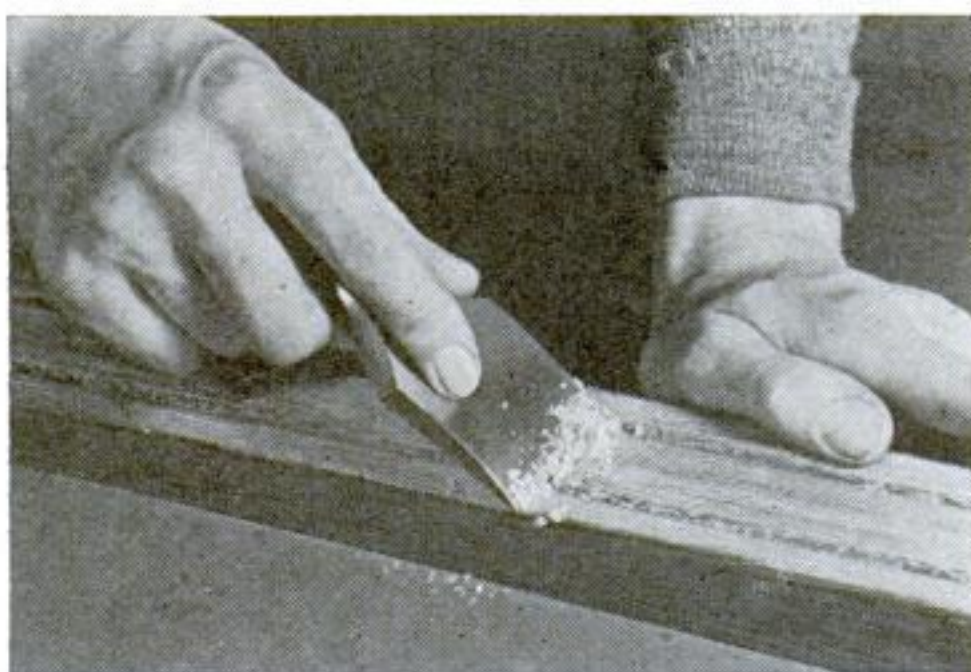
It is important to preserve the arch equally in both skis, so put them face to face and apply one clamp near the heels and another just before the tips start to curve. Although clamps are preferable, straps may be used to lash them together. Wedge a block of wood in the center of the opening formed by the two arches as illustrated.

The proper curvature of the tips must be maintained, so use a spreader. There are various types of spreaders, but one may easily be made from a piece of wood about 4 in. wide and of sufficient length to hold the tips apart. Both ends are notched and drilled for bolts, which pass through holes in the tips of the skis.

Grease any iron fittings and place the skis in a cool, dry cellar.—J. H. W.



Below: Scraping off the old wax



A spreader for holding the tips of the skis the right distance apart is easily made as shown at the right. The bolts pass through holes in the ski tips, which are held securely

SMALL DESK LAMP OF SHEET COPPER

WITH the exception of the shade, all pieces for this desk lamp are of 16-gauge soft sheet copper.

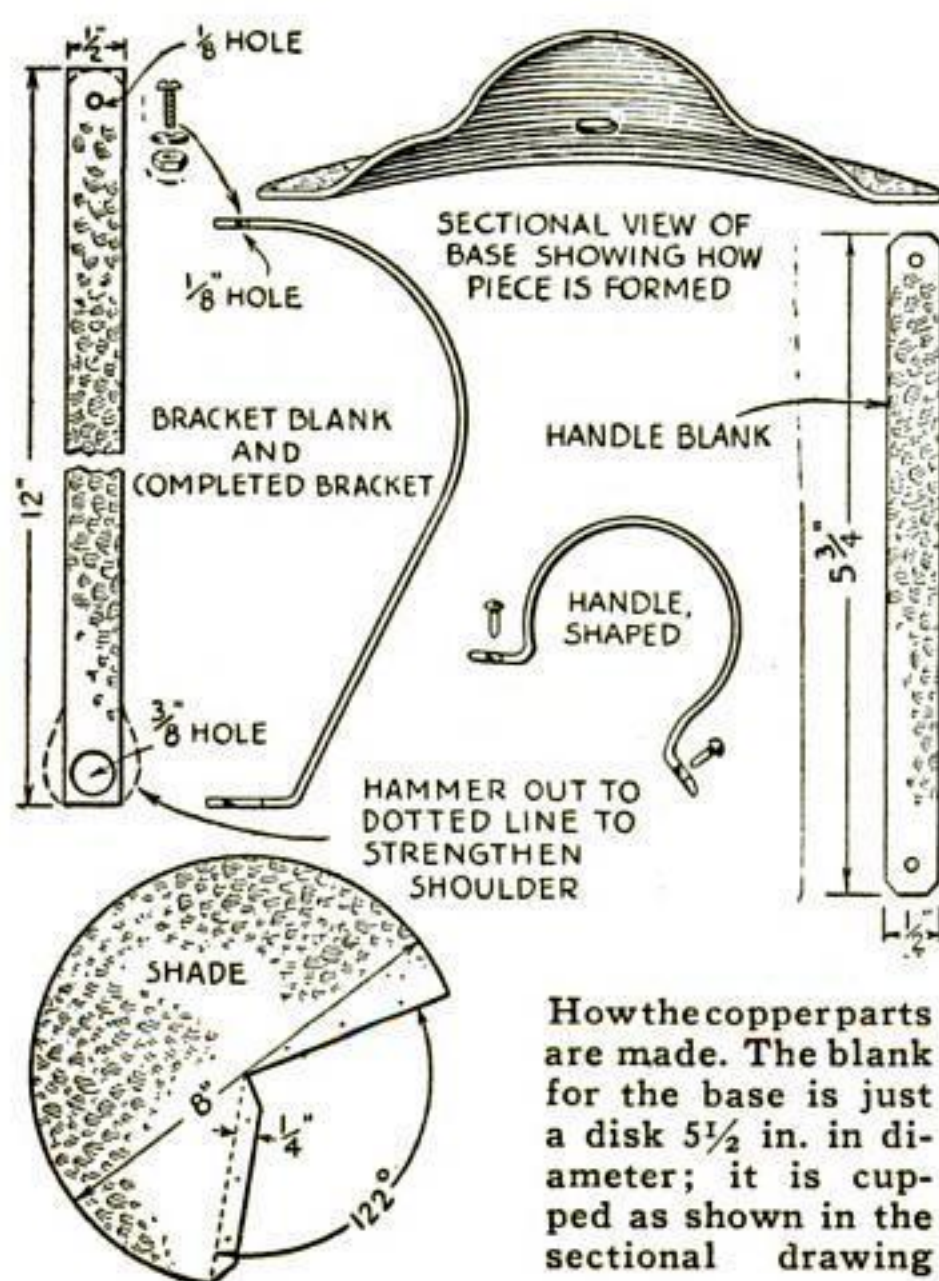
Cut a disk $5\frac{1}{2}$ in. in diameter for the base, and cup it by hammering from the inside. Drill a $\frac{3}{8}$ -in. hole in the center for the fixture bushing. Make the handle and shape it as indicated; then drill the holes

and rivet it to the base with escutcheon pins.

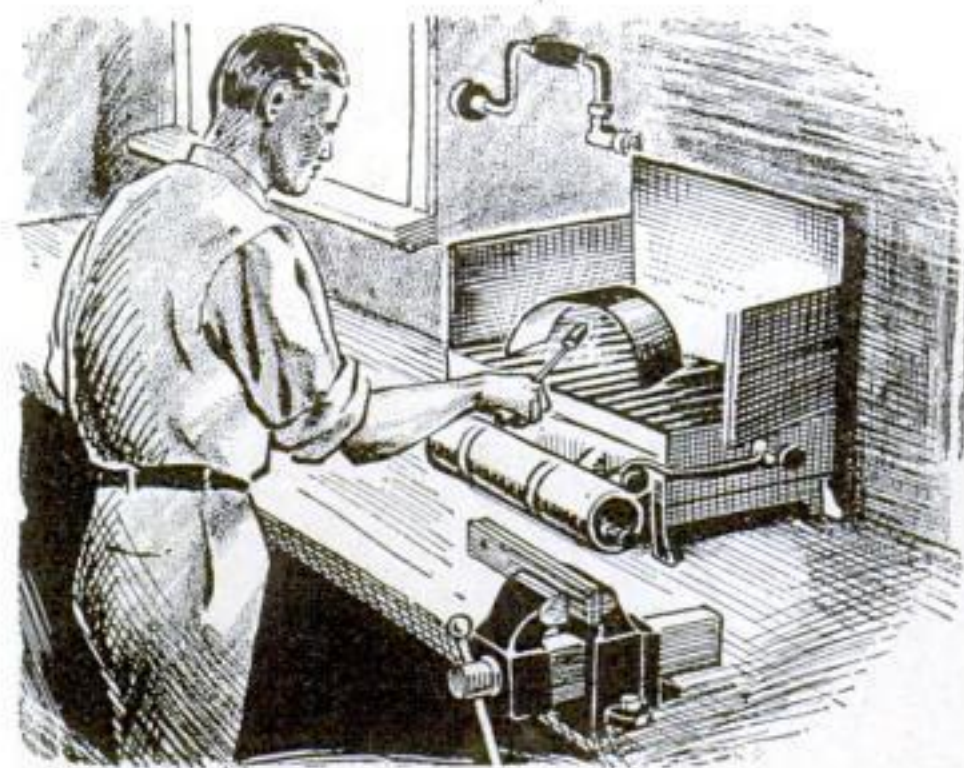
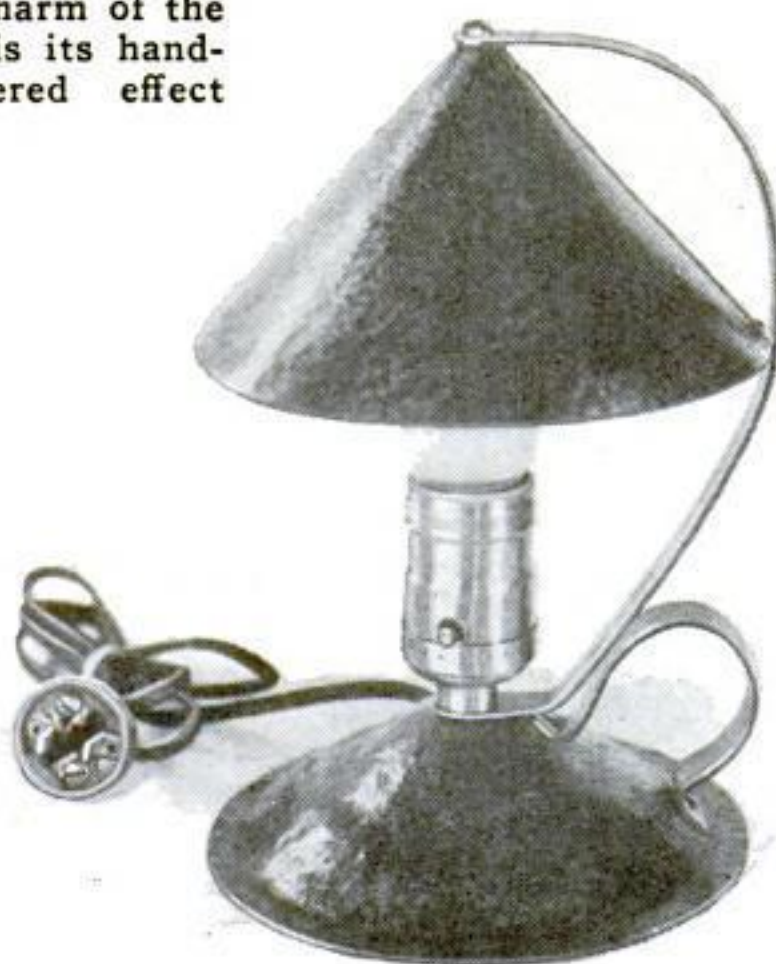
Make the shade from 24-gauge sheet copper. Hammer this, then bend it to shape and rivet. Drill a $\frac{3}{16}$ -in. hole through the topmost point. Next cut out and bend the bracket.

Dissolve a small piece of liver of sulphur in water and immerse all the pieces except the shade until the metal is a rich brown; then polish and lacquer the exposed surfaces. The shade should be colored only on the outside by washing it with the solution.—DICK HUTCHINSON.

The charm of the lamp is its hand-hammered effect



How the copper parts are made. The blank for the base is just a disk $5\frac{1}{2}$ in. in diameter; it is cupped as shown in the sectional drawing



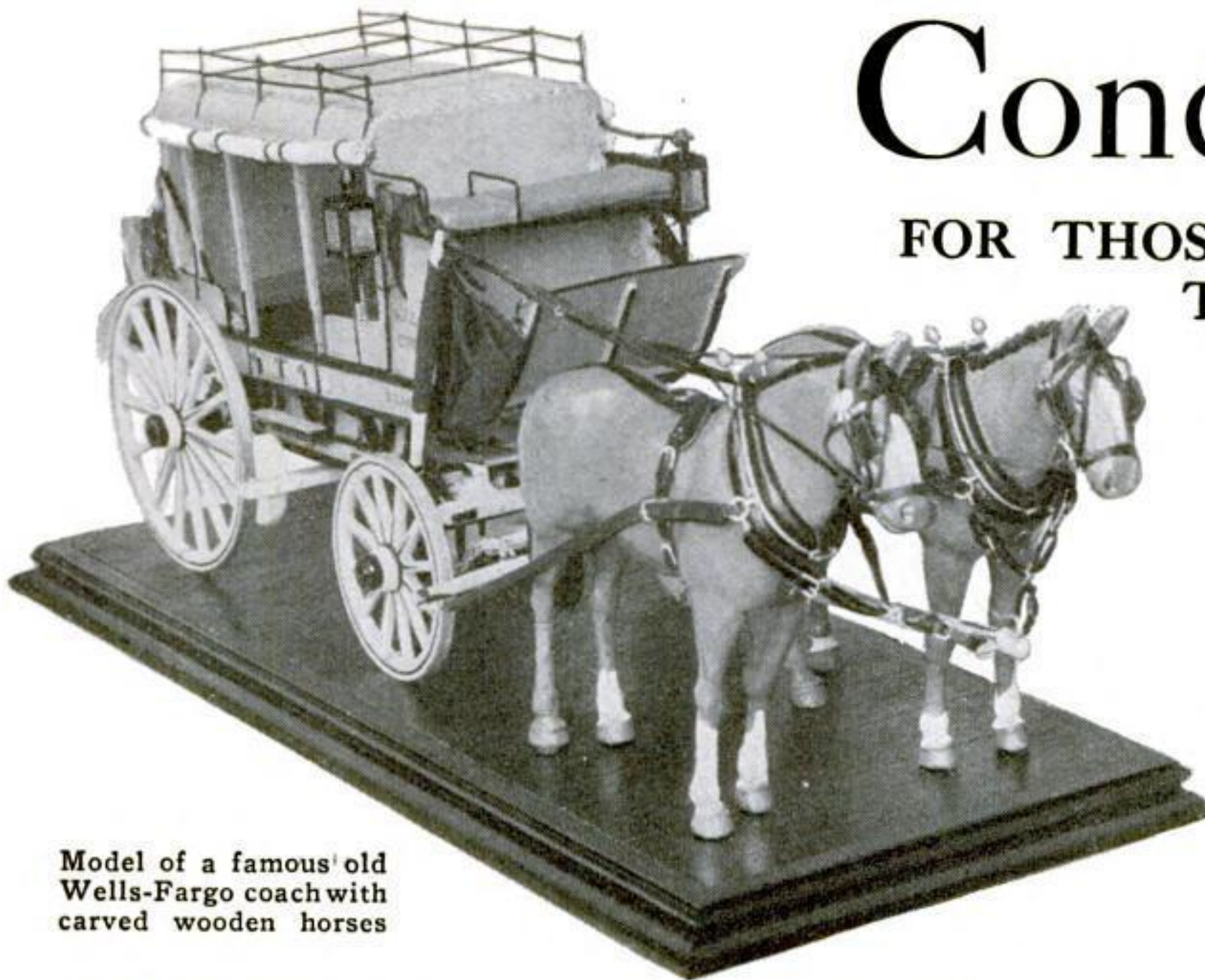
CAMP STOVE SUPPLIES HEAT AT WORKBENCH

MANY home workshops are so situated that gas is not available for heating purposes. The usual procedure is to run back and forth between the shop and the kitchen with melting pots, glue pots, soldering irons, and the like. This makes the kitchen look like a workshop.

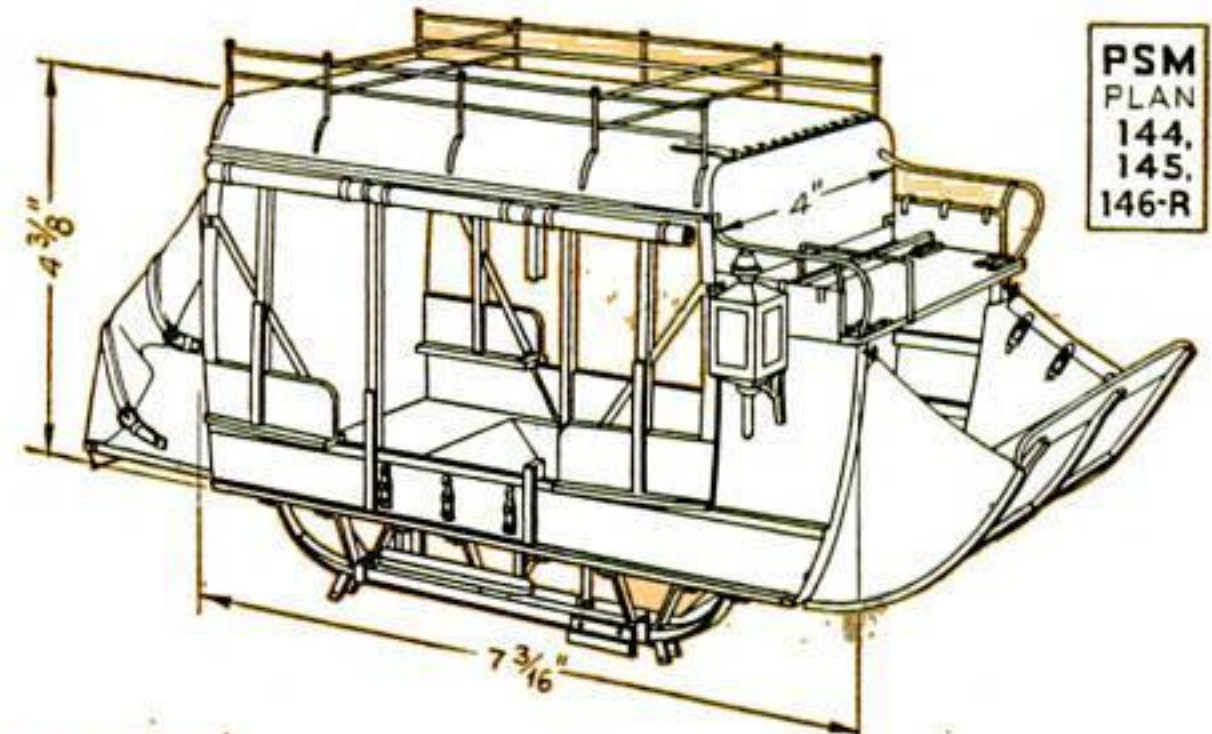
To solve this problem, I make use of an auto camp stove, which otherwise would be stored away except for a few days during the summer. If you have one like it, set it up permanently in your shop. It is easy to start, and its use in the shop will insure its being in working order for your picnics or vacation next summer. A small hood made from half a tin can will enable your soldering irons to be heated much more quickly.—B. K.

Condensed Plans

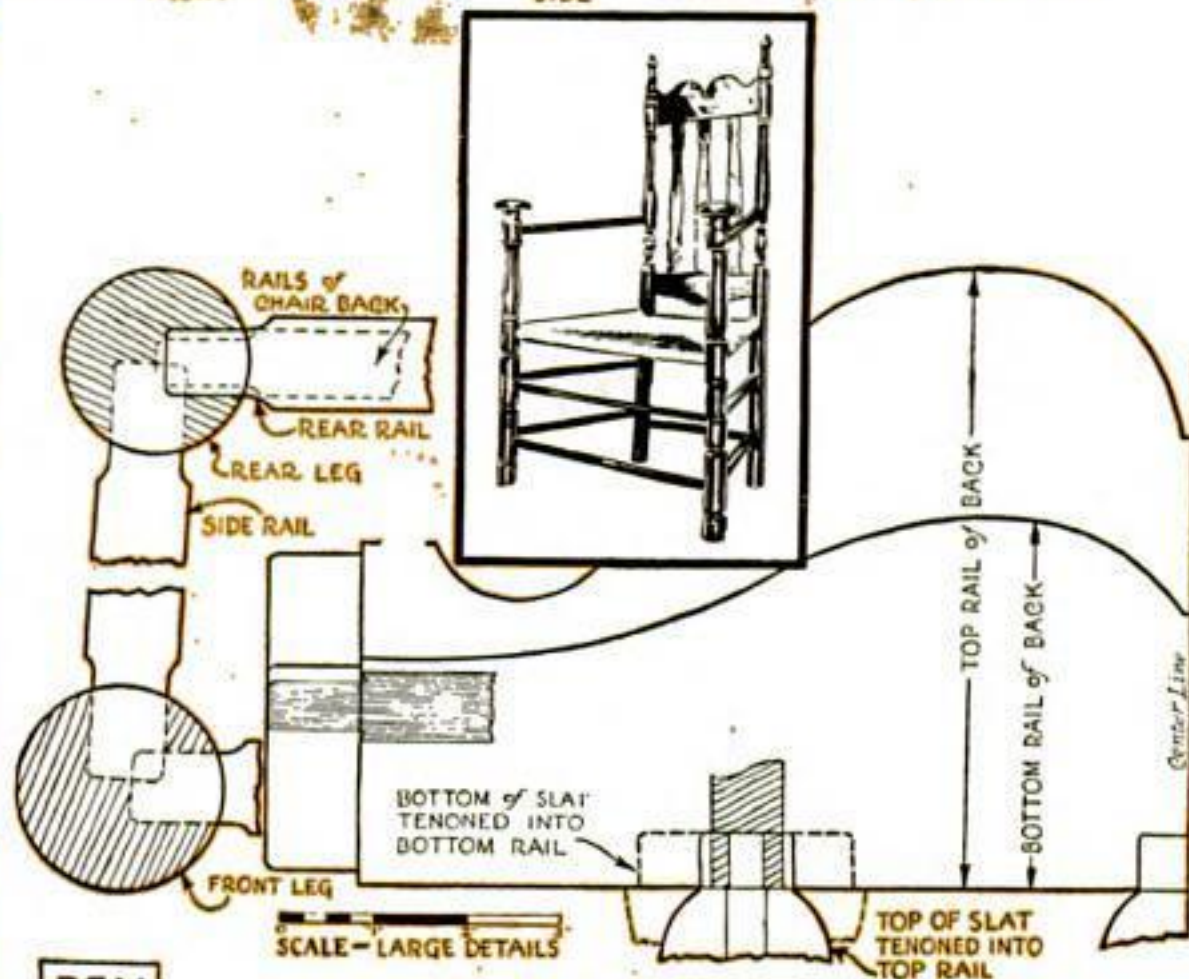
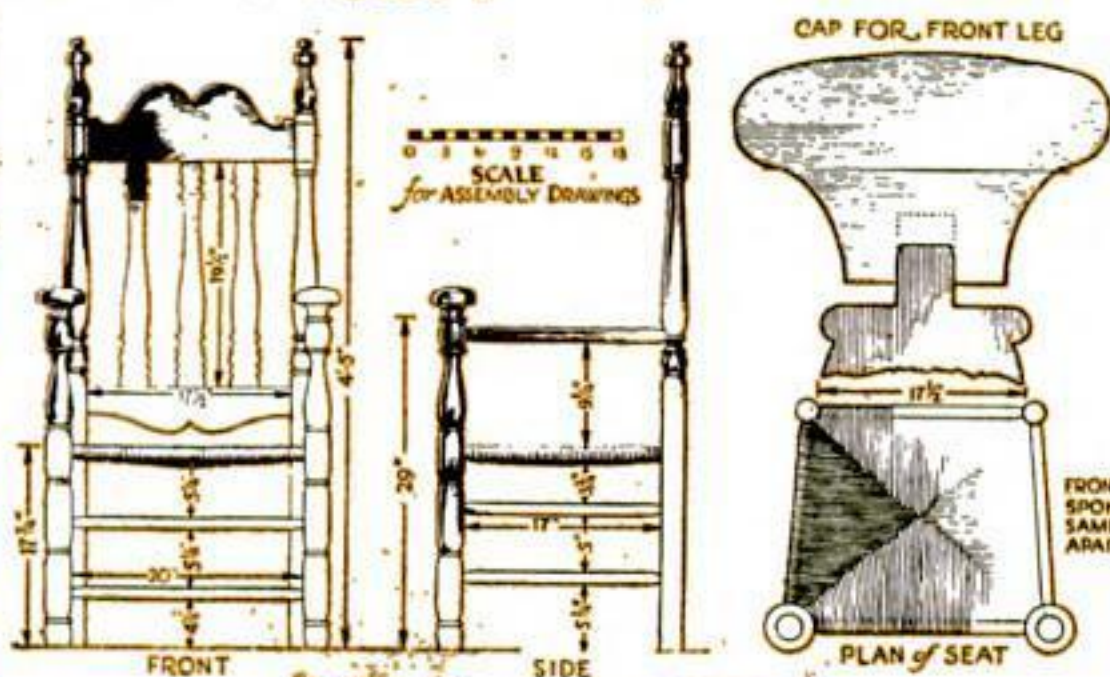
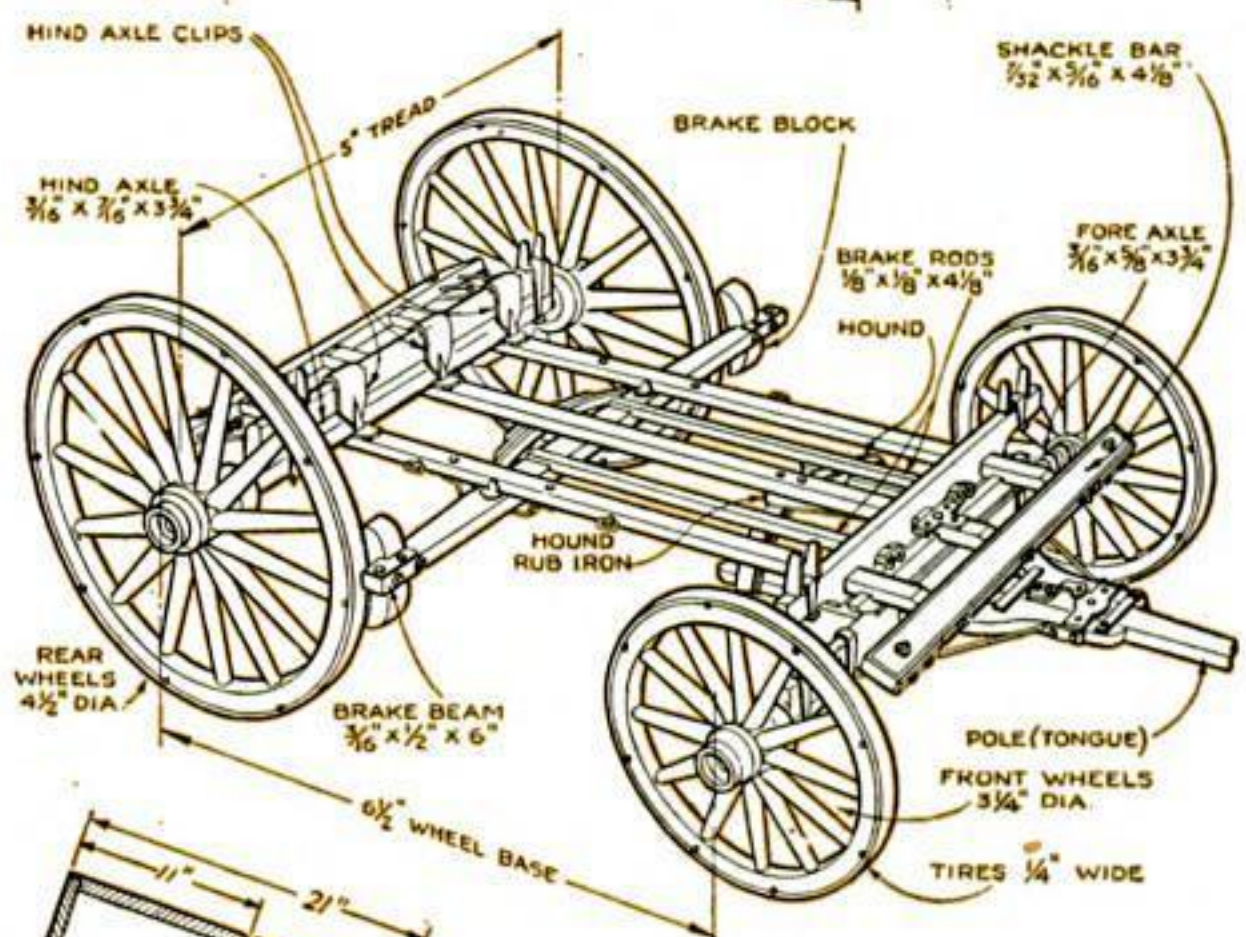
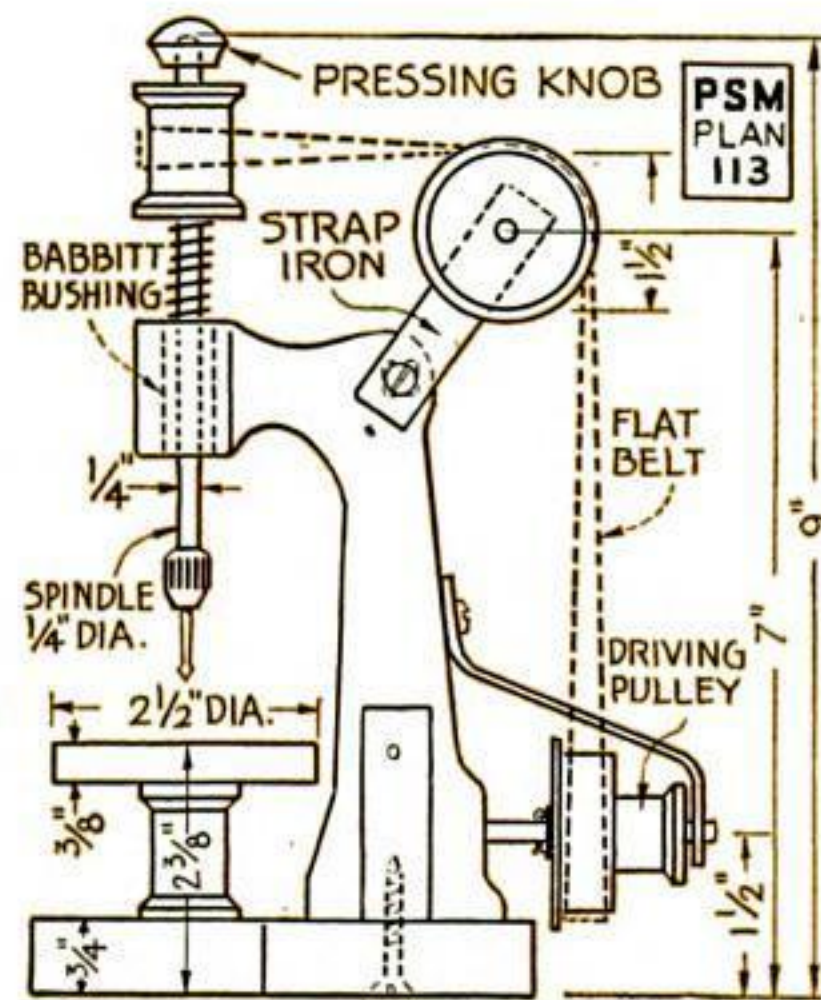
FOR THOSE WHO LIKE TO WORK OUT THEIR OWN DETAILS



Model of a famous old Wells-Fargo coach with carved wooden horses

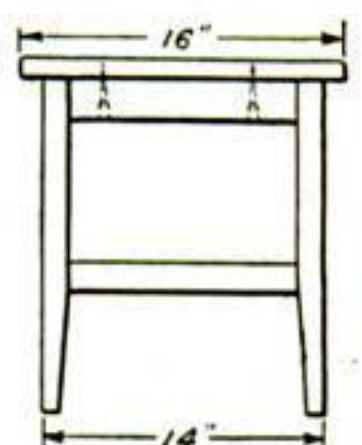
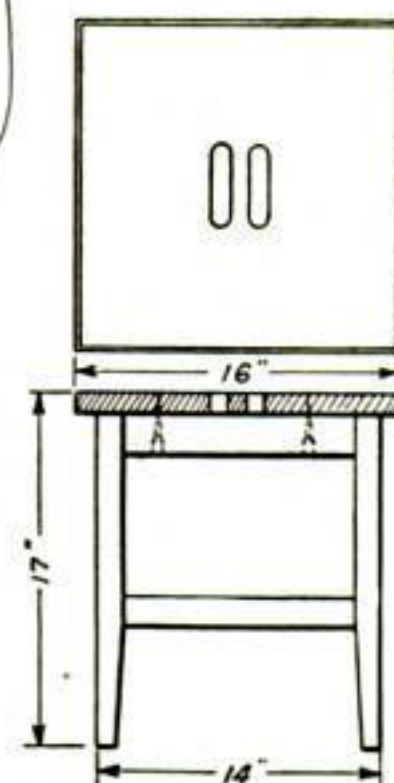
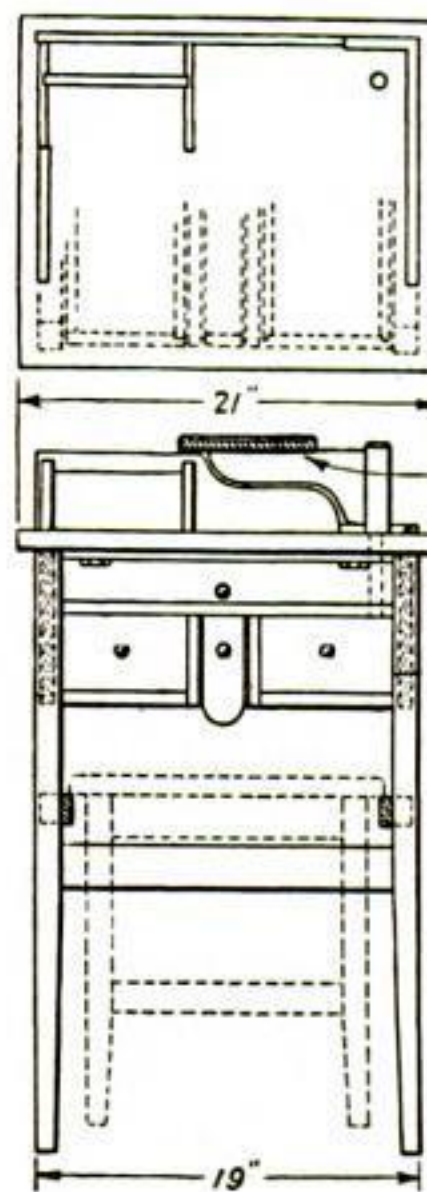
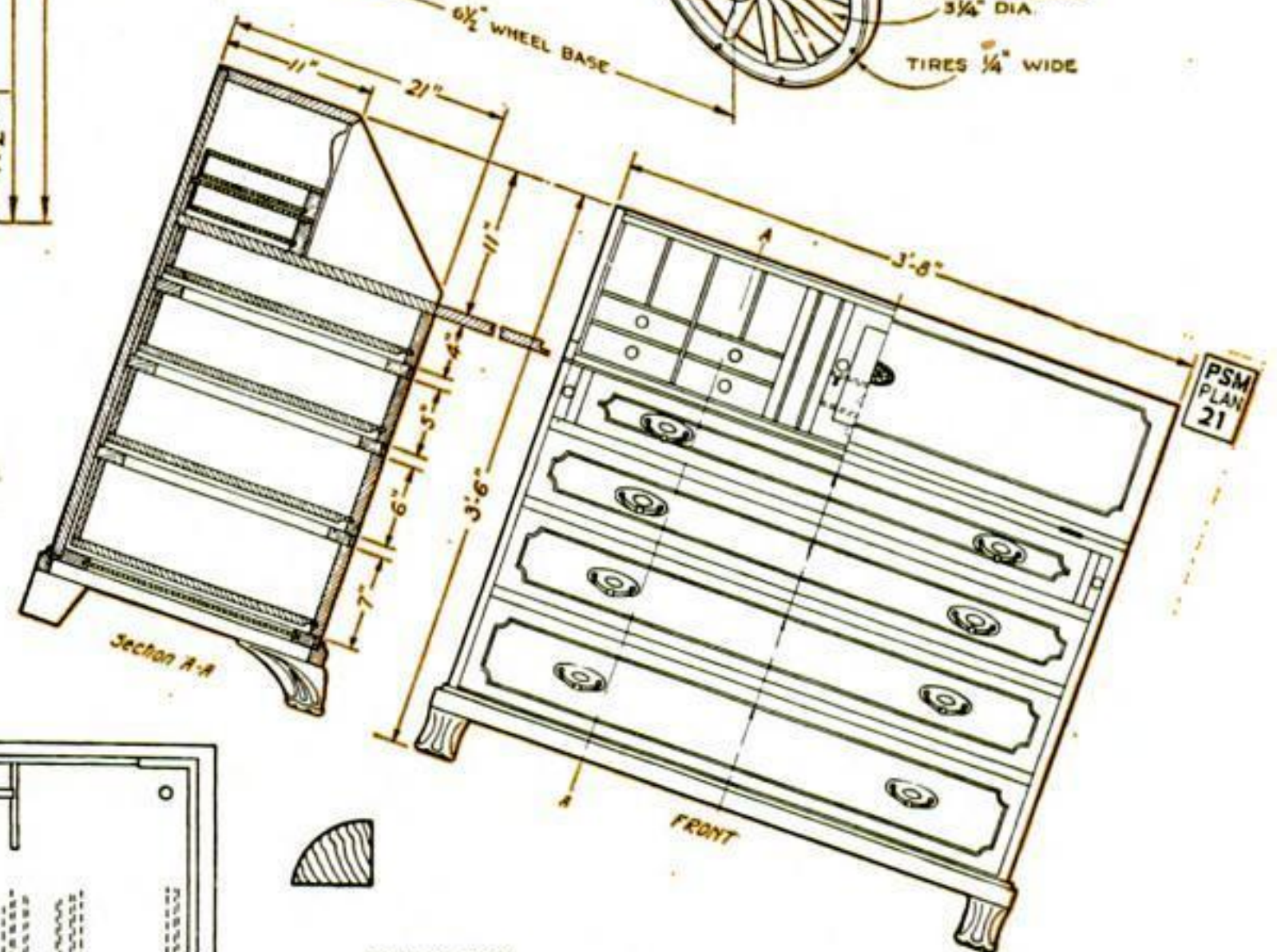


SO MANY readers expressed their appreciation of our first "plans-in-brief" page (P. S. M., Jan. '37, p. 74) that we are offering five more projects—a model of a Wells-Fargo coach said to have once been driven by "Buffalo Bill" Cody, a toy drill press, and three pieces of furniture. These condensed drawings are intended for those more experienced home workers who enjoy planning their own methods of construction. All the projects are taken from standard, fully detailed blueprints in the POPULAR SCIENCE MONTHLY series.



ARMCHAIR

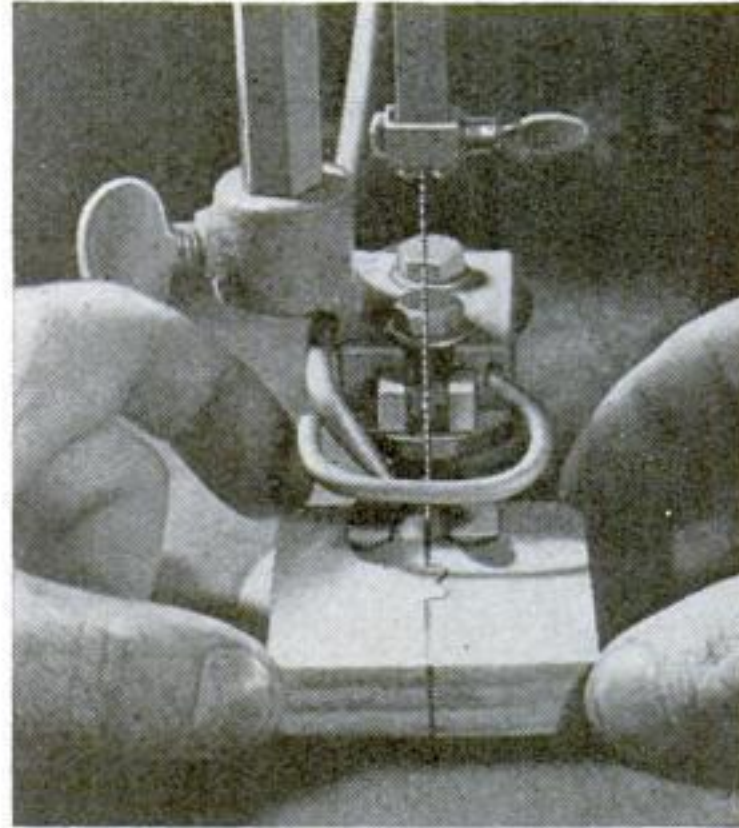
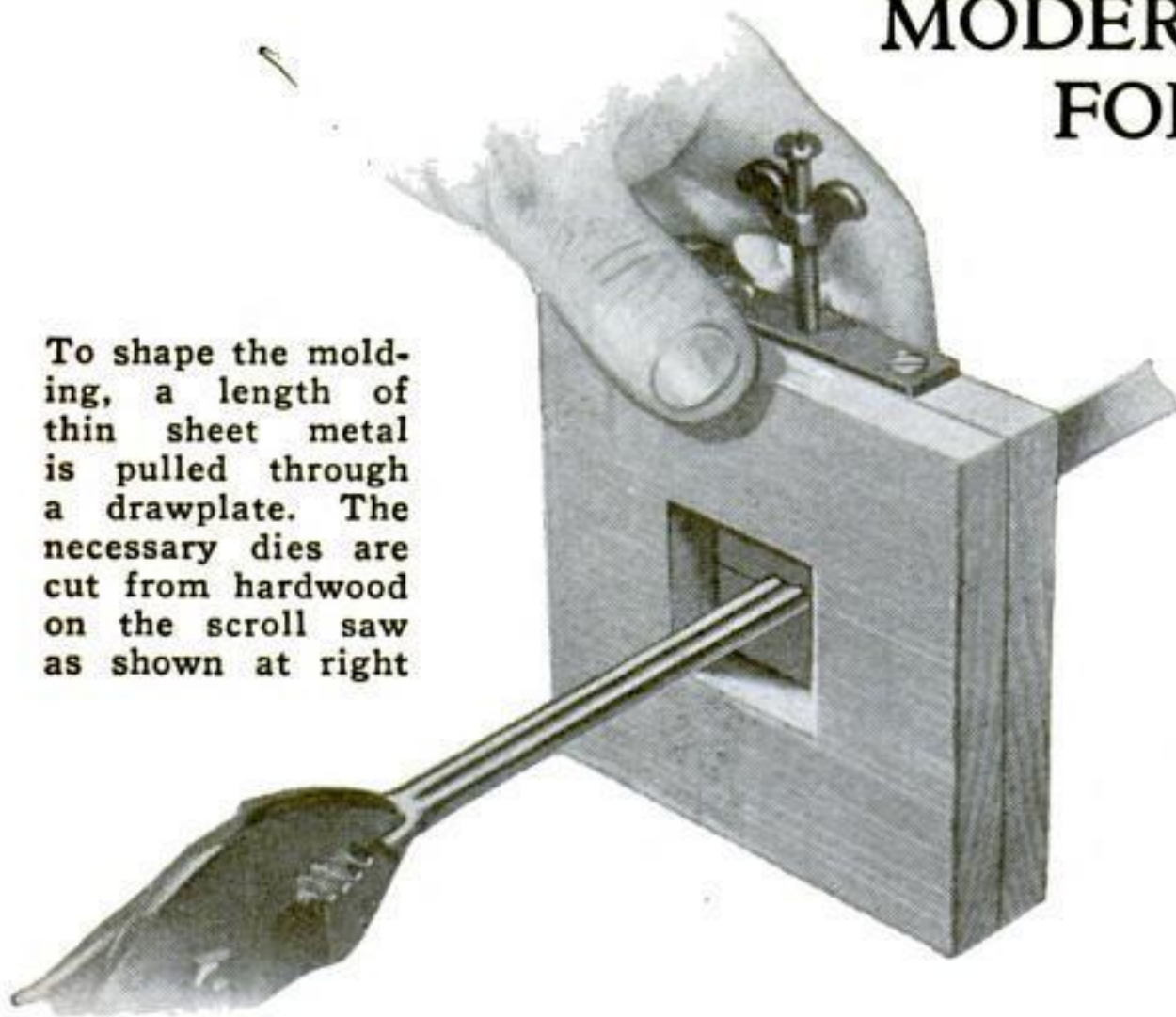
IN OAK or MAHOGANY with RUSH or CANE SEAT
THE DESIGN IS BASED ON AN EARLY AMERICAN MAPLE
ARM CHAIR IN THE METROPOLITAN MUSEUM OF ART, NEW YORK



Telephone table with a stool that slides under it on runners. Above: Slant-top writing desk and a toy drill press. Left: Armchair with rush or cane seat

MODERN-LOOKING METAL MOLDINGS FORMED WITH WOODEN DIES

To shape the molding, a length of thin sheet metal is pulled through a drawplate. The necessary dies are cut from hardwood on the scroll saw as shown at right



with the end of the strip in place, and part of it extending on the other side so that it can be grasped with pliers. Turn the clamping screw until the parts of the die mesh or seat themselves, but avoid more pressure than is required for forming the metal.

With the device held in a firm grip, you can pull the strip of metal gently through the drawplate. A moderate, even pull is best, but the amount of labor necessary depends on the thickness of the metal. This should be annealed by heating if it is hard and springy. Light copper and brass give the best results, and the operation is easier if the strips of metal are bent somewhat concave beforehand, to correspond in a general way to the bend they will receive in the drawplate.

Many modernistic designs can be worked out in these moldings for improving various fixtures about the home.—E. A. BOWER.

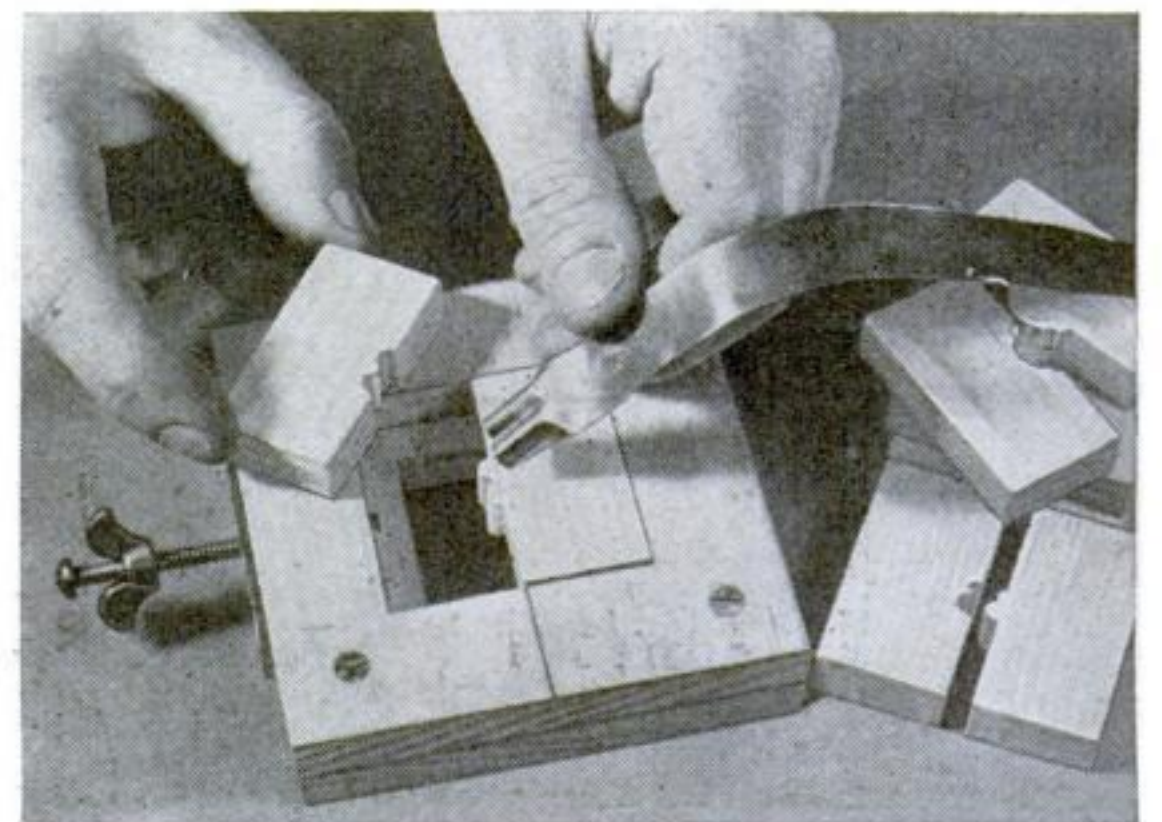
NARROW moldings are easy to form from strips of thin sheet metal by the use of a wooden drawplate, made as illustrated. It consists of two parts, a holder and a die. With the holder and an assortment of dies, which cost practically nothing, you can turn out attractive and modern-looking moldings in a variety of different styles or designs. They make excellent picture frames and can be used for trimming the edges of wood and metal-craft projects, for concealing joints, and in model making. It is possible to make model railway track, including ties, in this way.

To make the holder, cut two 4 by 4 by $\frac{1}{2}$ -in. pieces of hardwood. In the center of one cut a $1\frac{1}{2}$ -in. square hole; in the other, a 2-in. square hole. A brass plate with a threaded hole should then be screwed to one side of the latter to receive the set screw used in clamping the halves of the die together. You can then screw the two squares together and sand

the edges smooth. One or two coats of shellac will improve the appearance.

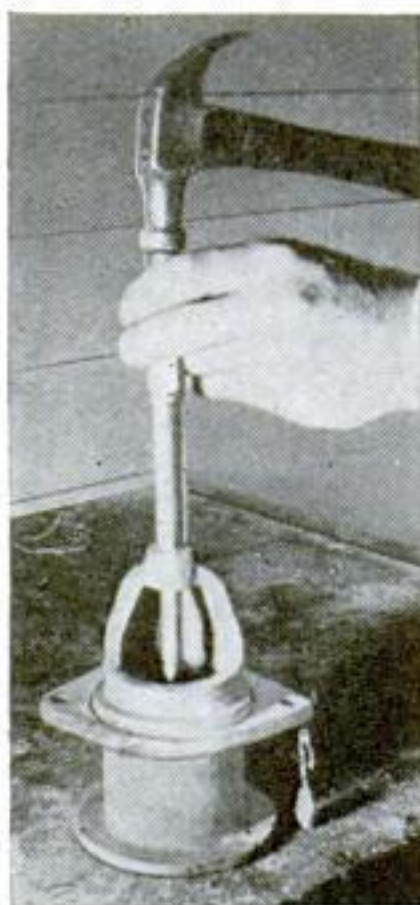
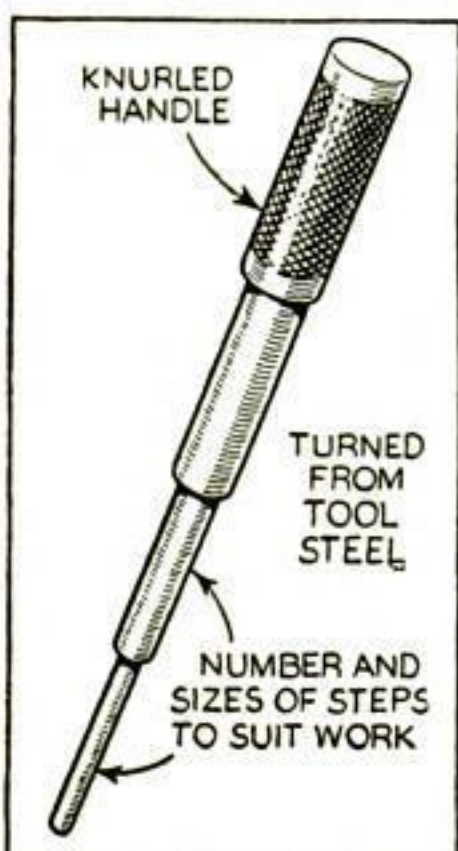
For the dies, cut a number of 2 by $\frac{1}{2}$ -in. hardwood squares; the harder the wood is, the better. The author found hard maple satisfactory. Draw an edge view of any simple molding design in the center; then extend lines on each side from the molding profile to the edges of the block. The die is best cut apart on a power scroll saw with a blade of the same thickness as the metal that is to be formed into moldings. Push the wood against the blade very slowly, both to assure a smooth cut and to avoid irregularities. Soak both faces of each die with light machine oil before they are put into use.

The illustration at right shows how the end of the strip of metal is started into the die or drawplate. Place the die in the holder



One of the pair of dies has been taken from the holder to show how the metal is started through the plate

The bushing remover in use and, below, a sketch of the tool



TOOL REMOVES BUSHINGS OF VARIOUS SIZES

WHEN several sizes of bushings frequently have to be removed and replaced, a bushing remover may be made with steps for the various sizes, thus eliminating the need of separate tools. The tool should be designed to suit the type of work being done. Be sure that the length of each step is sufficient to drive the bushing completely out before the shoulder is reached. It is well to knurl the handle so the tool can be handled easier.—BURL KNUTSON.

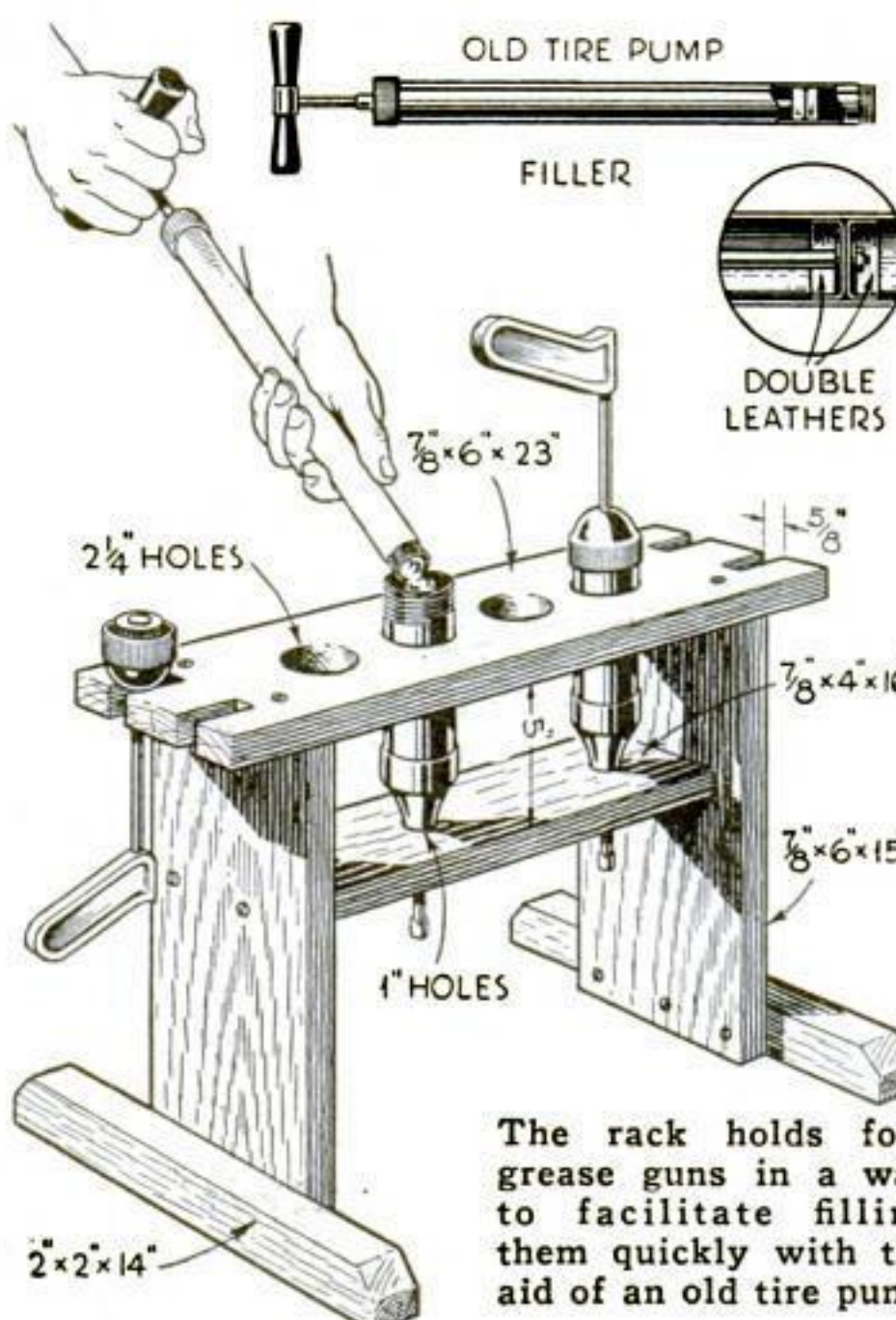
RACK AND FILLER FOR GREASE GUNS

KEEPING grease guns filled, accessible, and off the floor, is important, not only around the garage and service station but also on the modern farm. Nowadays tractors and many farm implements are greased by high-pressure grease-gun meth-

ods. One standard type of two-row corn picker alone has more than 225 high-pressure fittings that must be gone over daily when the machine is being used. Much time and annoyance can be saved in all work of this kind by the homemade grease-gun equipment illustrated.

The rack is made of $\frac{7}{8}$ -in. boards. If the dimensions on the drawing are followed, the rack will hold four guns. Four $2\frac{1}{4}$ -in. holes are bored in the top board, and 1-in. holes are bored in the lower board directly under them. The top board, it will be noted, extends 2 in. at each end, and the ends are notched to hold the tops of the guns while they are being filled with grease.

Anyone who has filled a grease gun with a paddle or an old table knife knows that it is a slow and mussy task. An old tire pump, however, can be converted into a filler that does the job quickly and without any waste or trouble. The foot or base of the pump is discarded, and the plunger is equipped with two leathers, one turned each way, to make it a double-acting plunger. The old pump now acts as syringe. Grease is drawn into the pump cylinder by pulling up on the handle, and downward pressure on the handle delivers the grease into the grease guns, which are held in the rack.—HAROLD JACKSON.



The rack holds four grease guns in a way to facilitate filling them quickly with the aid of an old tire pump

An Electric Timer

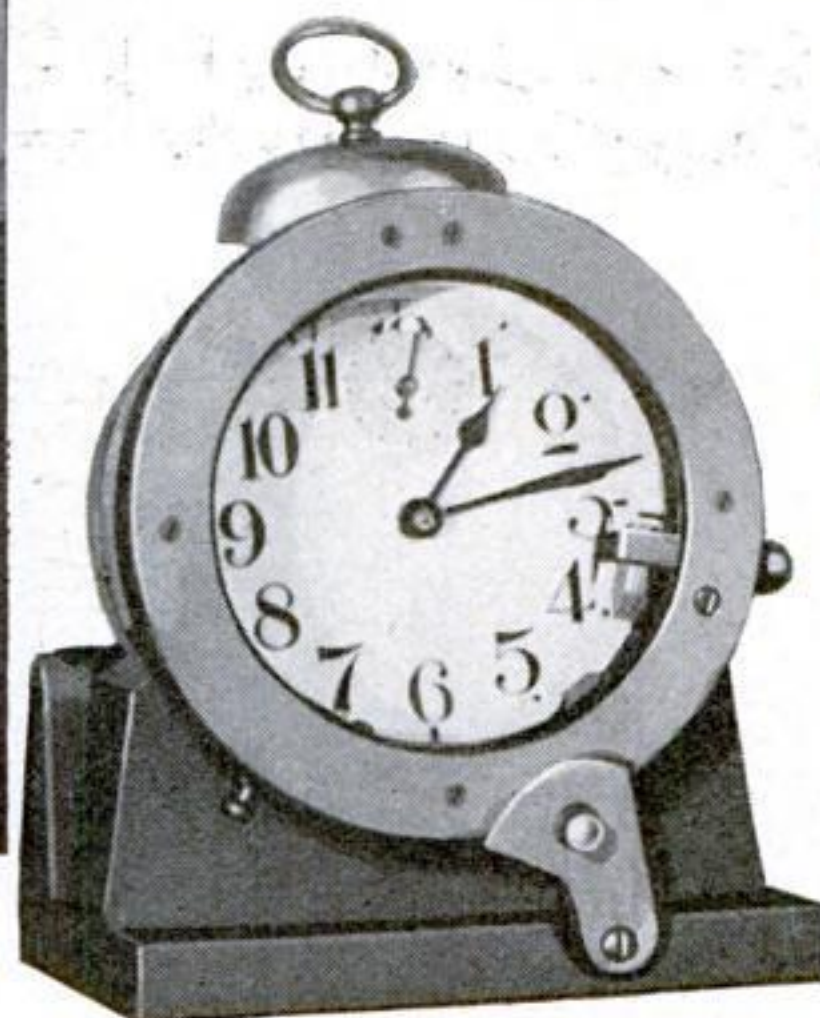
TO JOG YOUR MEMORY

Simply made device sounds a buzzer when it's time to turn on the radio, take the cake out of the oven, remove films from the developer, or do any similar task

By J. D. GARFIELD



Made from an old alarm clock, this timer rivals in efficiency and accuracy the somewhat expensive commercial devices known as "short-period call clocks"



in a concentric position on the front edge of the clock case by six guide pins, which loosely ride on the edge and permit free rotation. To hold the ring closely to the clock case, two spring arms of stiff spring brass are screwed to the inner wall of the ring, opposite to each other. Their free ends have bent ears or clips that extend outward and slip under the rear surface of the ring, and also under the clockcase bezel or flange, as shown in the drawing of the side view of the clock. These clips are maintained in position under the case flange by the pressure of the spring arms, but may be pressed inward to a releasing position by means

HOW often have you missed getting a much desired radio broadcast because you forgot to turn on the set in time? How many times has food been burnt or some important matter overlooked for lack of a timely reminder?

To jog your memory and prevent such domestic calamities is one of the many purposes of the so-called "short-period call clocks" which have recently been put on the market. These clocks can be quickly set to sound a warning note at a pre-arranged time—from a minute up to two hours.

An inexpensive attachment for an ordinary alarm clock can be made that will transform it into a call clock equal in most respects, except possibly appearance, to any of the somewhat costly commercial clocks. Furthermore, the original alarm element of the old clock is always available for desired calls beyond the two hour limit.

If at first glance the design of this clock attachment seems to be a trifle crude, this is entirely for the benefit of the man who must rely on a few hand tools.

The materials required are an alarm clock from which the glass has been removed; a soft pine board about $\frac{1}{2}$ by 6 by 18 in., planed on both sides; a piece of soft sheet brass about 8 by 10 in. of moderately thin gauge, and a piece of hard, springy sheet brass about 6 by 6 in. of a slightly thicker gauge. Also, an electric buzzer, two 1-in. diameter dry-cell flashlight batteries, and a few small screws and screw hooks.

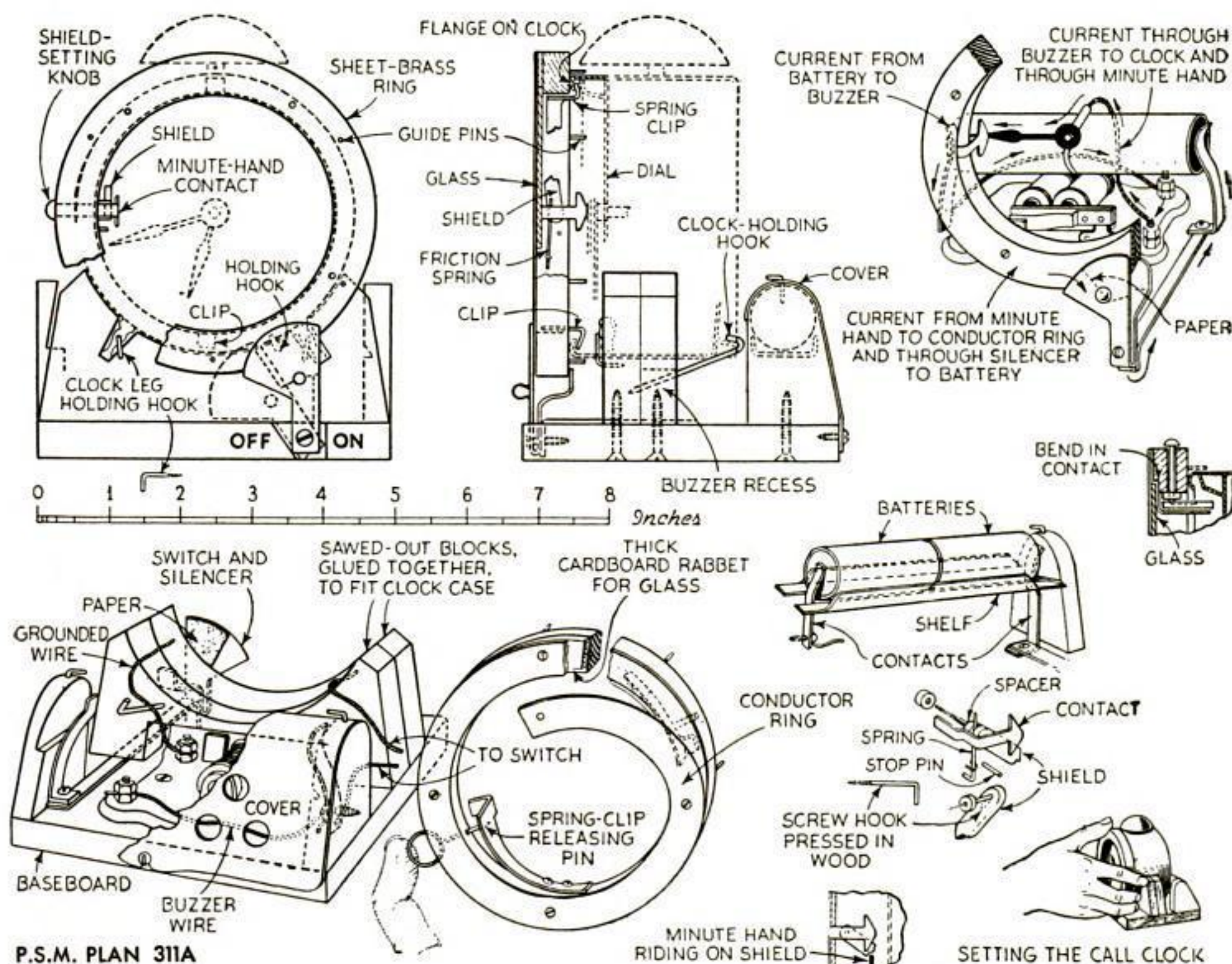
Make the baseboard about $\frac{1}{2}$ by $4\frac{1}{2}$ by 5 in. Next shape the two clock-supporting blocks. One of these (the back block) should have a sawed-out recess, as shown,

for the buzzer, and the front block will require two notches or depressions for the clock legs. Glue the blocks together and screw them to the baseboard. Shape and fasten two small $\frac{5}{16}$ -in. thick end blocks for the battery support.

The $\frac{1}{2}$ -in. thick wooden ring may now be sawed to scale. This ring is supported

of a stout pin as illustrated in a sketch. By this method the ring may at any time be removed from the clock.

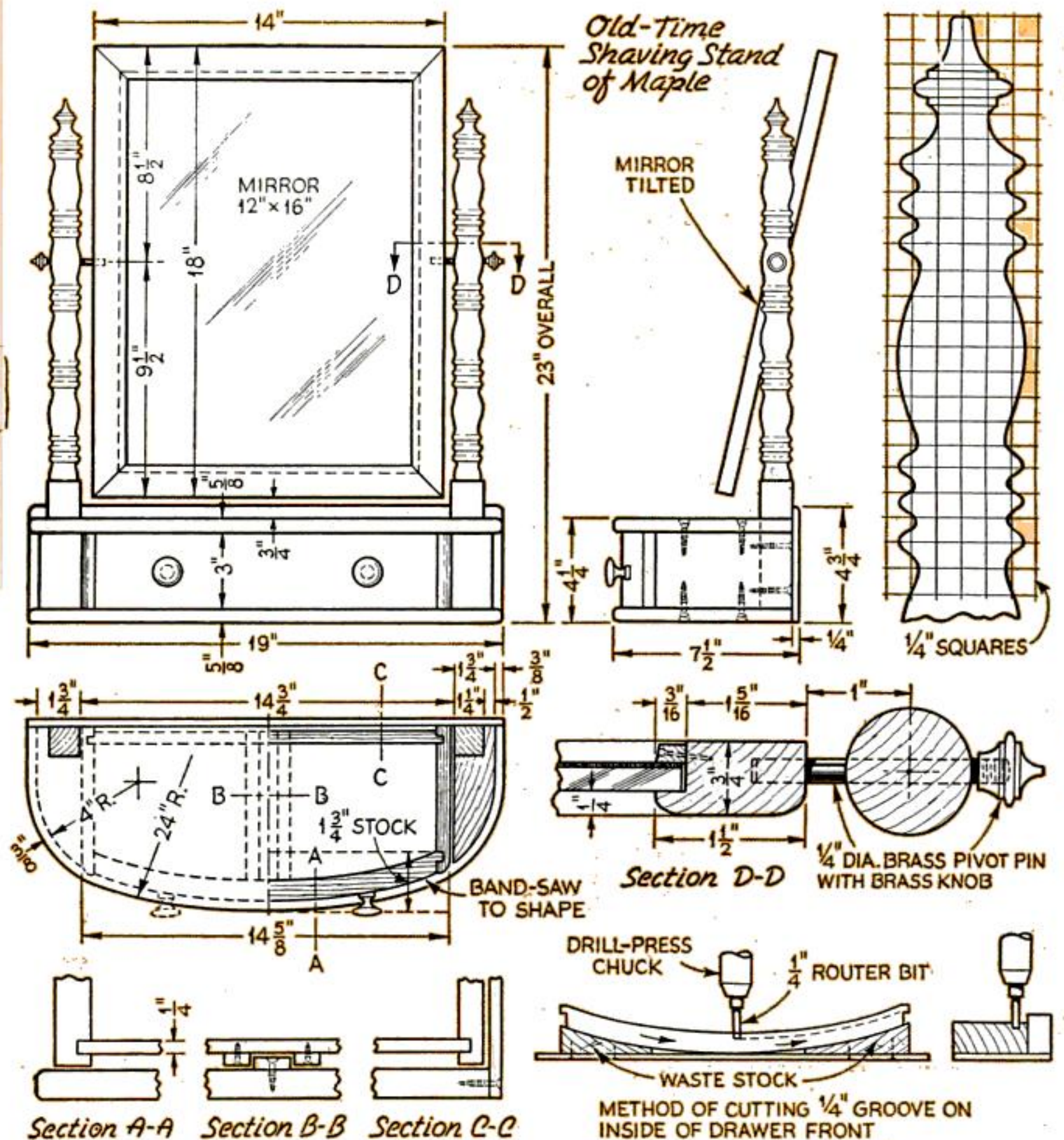
To complete the sawed-out ring, a rabbit to hold the glass crystal is necessary. This is easily provided by a cut-out cardboard ring of the same thickness as the glass and of the [\(Continued on page 120\)](#)



Front and side views of the complete assembly with the clock shown in dotted lines; and sketches of the base, the contact ring, the contact and shield, the circuit connections, and other details

DRESSING MIRROR FOR USE IN COLONIAL BEDROOM

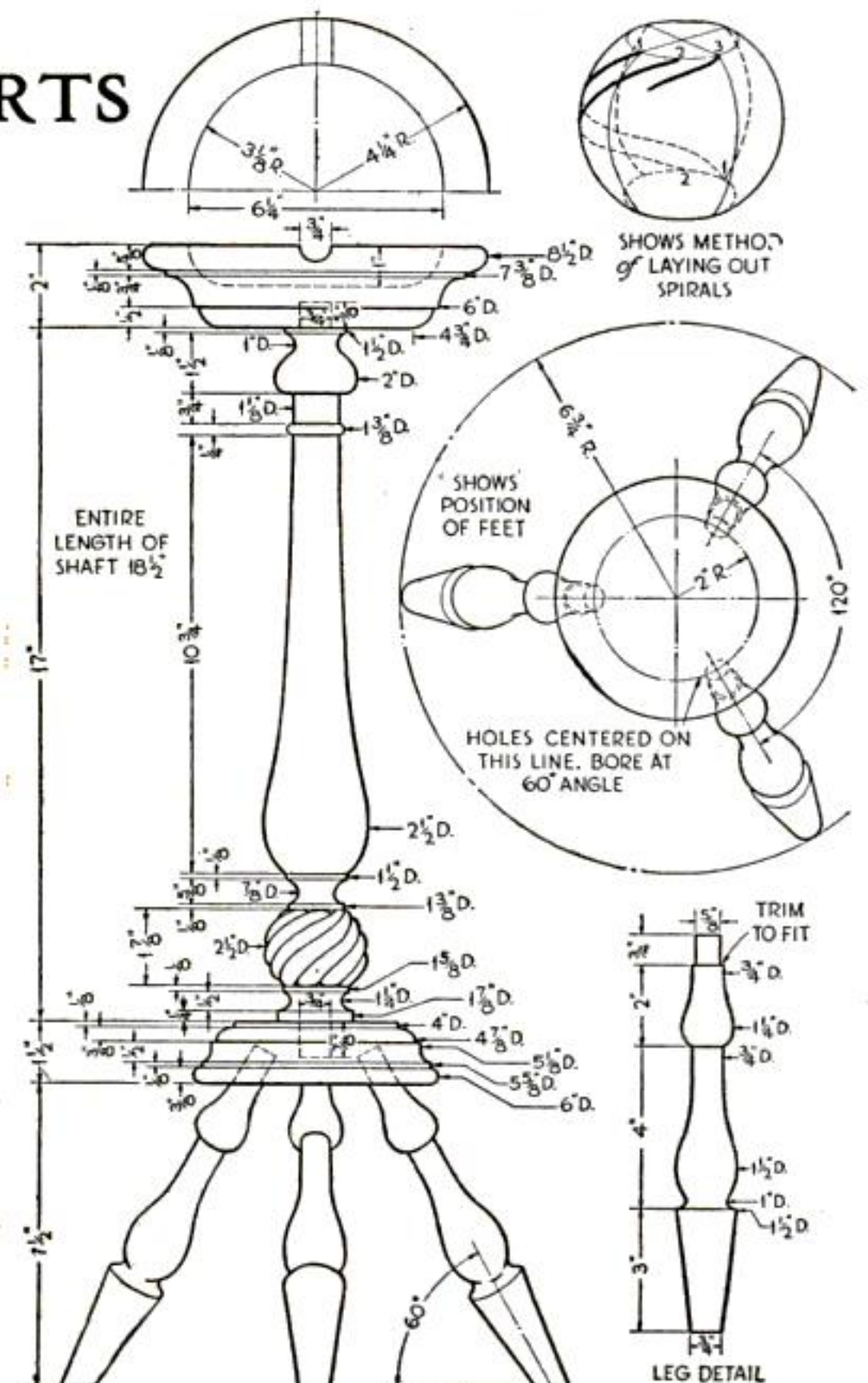
Assemble with screws and glue, countersinking and plugging the screws that hold down the top. The knob on the brass pivot pin may



eter and $\frac{3}{4}$ in. long for the knob, and drill and tap it for the $\frac{1}{4}$ -in. brass pivot pin.—DONALD A. PRICE.

To lay out the spiral, divide the turned ball into four equal parts with longitudinal lines. The spiral may then be drawn to go halfway around the ball in its course from the top to the bottom of the ball. It may

A black and white line drawing of an elderly man with glasses, wearing a suit and tie, sitting in a large, ornate armchair. He is holding a large newspaper open in front of him, reading it intently. His right hand is resting on his chin. To the left of the chair is a small, three-legged side table with a decorative lamp that has a flame. The background is a simple, textured wall. The style is that of a classic comic book or magazine illustration.



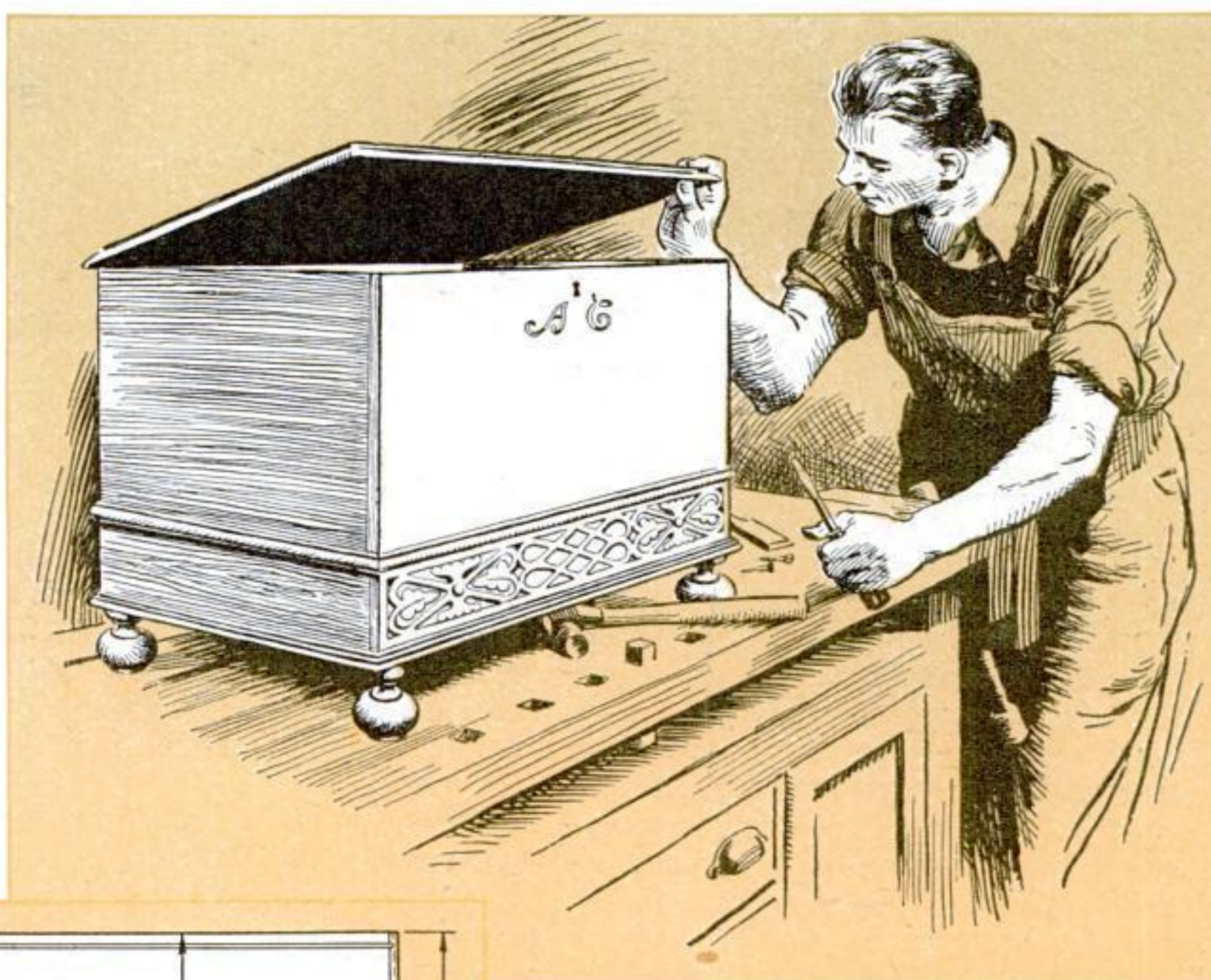
Woodworkers *to* Build

STRAPWORK CARVING SETS OFF USEFUL LITTLE PINE CHEST

MANY uses may be found for a small early Colonial pine chest like the one shown—for example, in the nursery to store the baby's clothing. Do not be alarmed by the carving on the drawer front; it is very simple. There is no modeling except a very little hollowing out at the leaves, and a slight lowering of the strapwork where one band appears to go under another.

First get out the front and the back, making them a few inches longer than their actual size so that when the grooves have been cut and the chest is being assembled, the ends will not split out. Groove the front and back $\frac{3}{8}$ by $\frac{3}{8}$ in. to receive the tongues, which are later cut on the ends. Now groove the ends and back, and rabbet the lower edge of the front for the floor and bottom. The chest may then be assembled. Be sure it is square.

The drawer front is made so that it covers the ends on the chest to prevent them from showing.

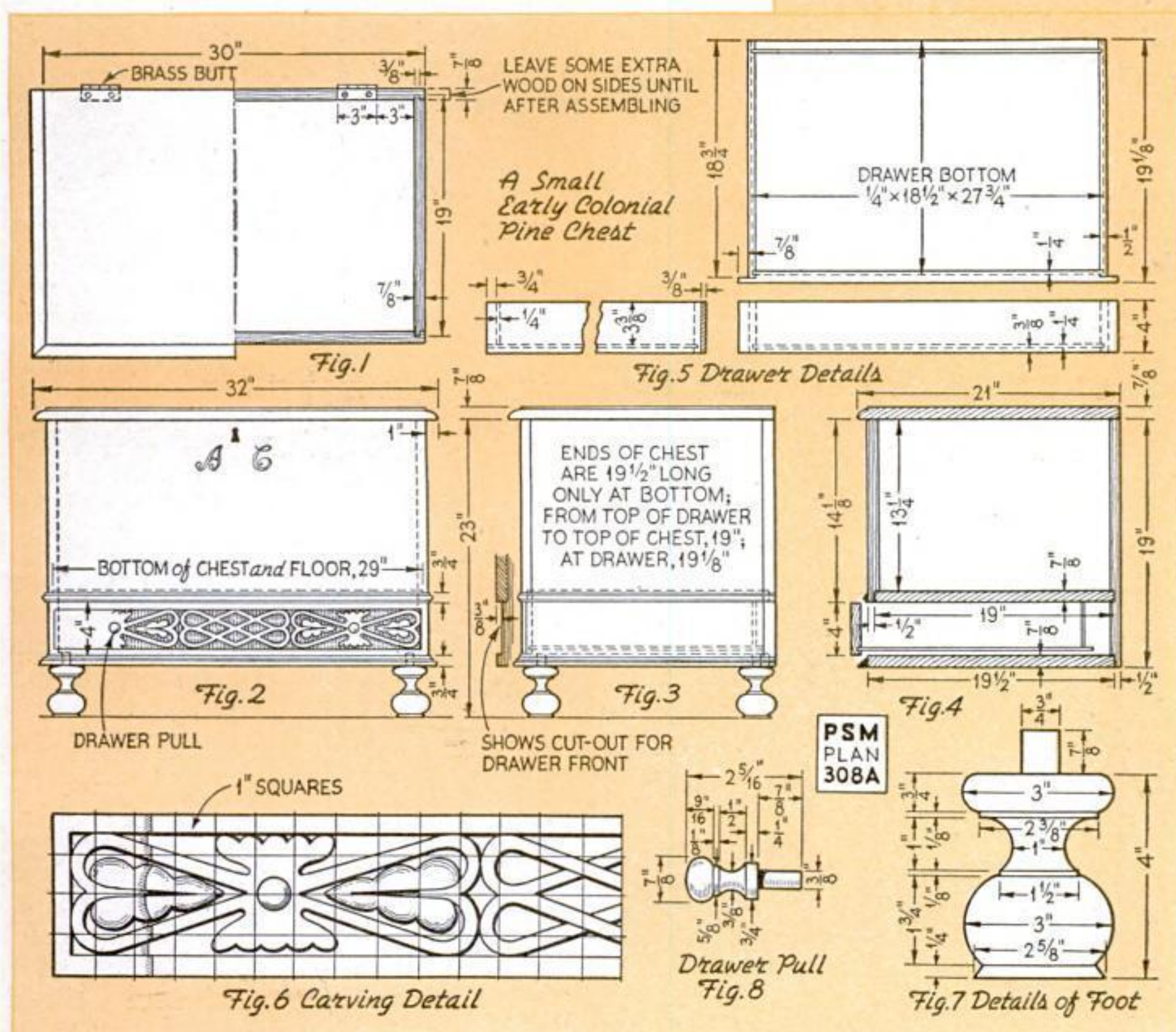


The chest has a drawer in the bottom, the front of which is relieved by a simple type of flat carving. The initials are cut in with a V-tool.

Turn the feet and bore holes into the bottom of the chest to fasten them. Fasten the molding.

Next make the lid, which may be molded on a shaper or by hand.

Most pine chests of this type are finished with orange shellac; then rubbed down and waxed.—FRANKLIN H. GOTTSHALL.



List of Materials

No. of Pieces	Description	T.	W.	L.
1	Lid	$\frac{7}{8}$	21	32
1	Front	$\frac{7}{8}$	$14\frac{1}{8}$	30
1	Back	$\frac{7}{8}$	19	30
1	Bottom of chest	$\frac{7}{8}$	$19\frac{1}{2}$	29
1	Floor of chest	$\frac{7}{8}$	19	29
2	Ends of chest	$\frac{7}{8}$	19	$19\frac{1}{2}$
1	Drawer front	$\frac{7}{8}$	4	30
4	Feet	3	3	$4\frac{7}{8}$
2	Drawer sides	$\frac{1}{2}$	4	$18\frac{3}{4}$
1	Drawer back	$\frac{1}{4}$	$3\frac{3}{8}$	$27\frac{3}{4}$
1	Drawer bottom (plywood)	$\frac{1}{4}$	$18\frac{1}{2}$	$27\frac{3}{4}$

Molding (see drawing)
NOTE: All dimensions are given in inches and are finished sizes.

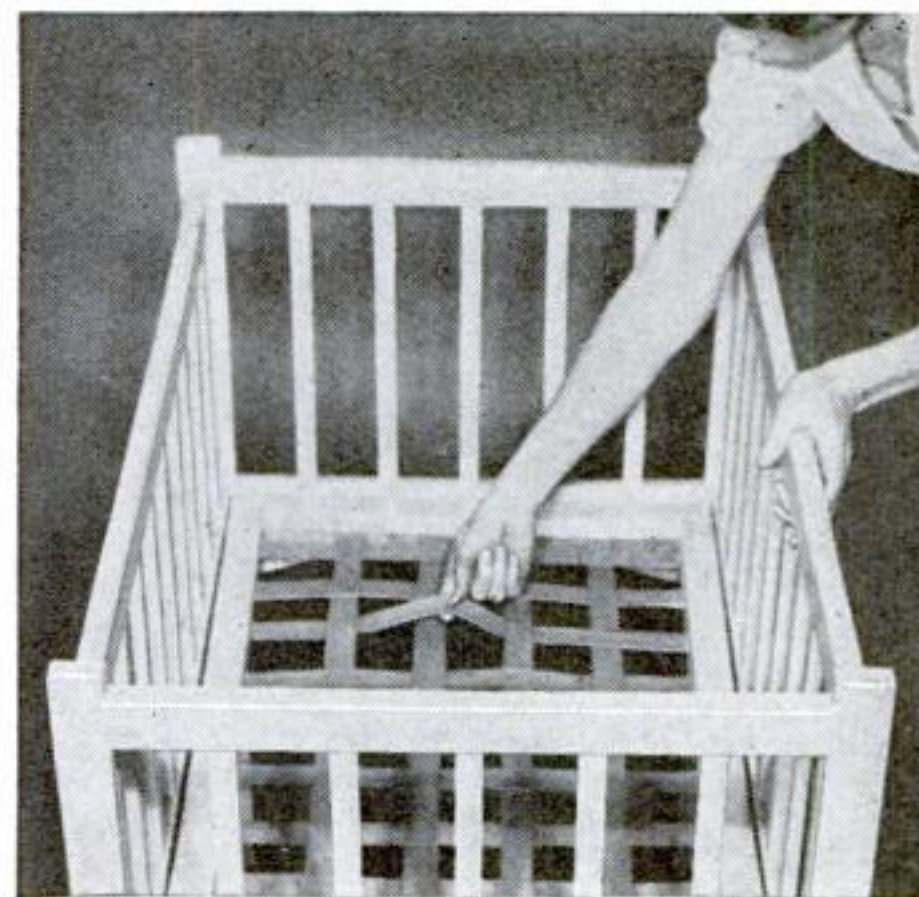
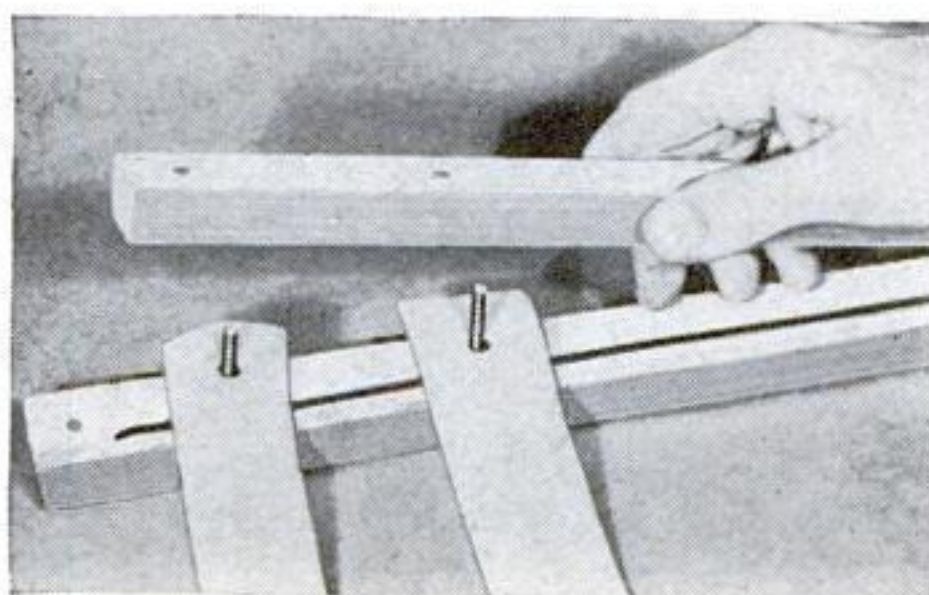
INNER-TUBE STRIPS ACT AS SPRINGS FOR CRIB

WHEN it is necessary to make a crib or bed for a child, it is always a problem to provide suitable springs. The same question arises, too, when an old crib is to be renovated, because ordinary springs such as are used in commercial cribs have a habit of sagging badly after considerable use. They have to be replaced if the crib is to be put into comfortable shape for further use.

One of the simplest and best solutions is to make the springs from the heavy inner tubes used in truck tires. A wire is first run along the lower section of the frame as shown at the right in order to provide a firm grip and prevent the interwoven rubber strips from pulling out after they have

been clamped by the upper strips of wood.

To get the rubber strips as tight as possible, clamp them between the frame pieces and stretch them before fastening the corners.—BENJAMIN NIELSEN.



Wire placed along the frame helps to grip the rubber, preventing it from pulling out.

Money-Saving Ways

FLAWLESS BALLOON CEILING

Conceals Badly Cracked Plaster

By RALPH G. WARING

PERHAPS nothing is quite so appalling to a housewife as to have plaster dust sift endlessly down from a cracked ceiling over her clean carpets, draperies, and furniture. This difficulty is a common one, too, particularly with the older type of plastered ceilings. The cracks and checks gradually become enlarged to alarming proportions in spite of occasional screws or cloth patches applied as emergency measures.

Something radical must be done to end the ever-present menace that such a ceiling will fall. Fortunately, there is a sensible and practical way out of the trouble—one that avoids the dirt and part of the expense of a new plaster job. It is to install a so-called "balloon ceiling," which is a suspended ceiling of tightly stretched and painted cloth.

To my mind this makes the finest type of ceiling since it appears mechanically more perfect than a plaster ceiling can possibly be. In fact, if I were building a new house, I should cover the joists with a soft type of $\frac{1}{2}$ -in. insulation board and then apply a balloon ceiling, knowing that when the job is finished I should never be bothered with any of the troubles inherent in plaster.

First, outline with colored chalk or soft pencil all plaster areas that are too soft or loose to support themselves any longer. These can be found best by tapping lightly with a stick or finger.

Small areas or streaks along running cracks can readily be reënforced by pasting over a covering of strong new unbleached muslin. Apply a generous coating of strong wall-paper paste to the plaster, stretch out the patch, and brush another coat of paste on the cloth, which should be large enough to lap well over the adjacent sound plaster.

Any weak area larger than a few square feet should be supported by a suitably cut section of wall board, screwed as far as practicable to the ceiling joists. Space the margins of the board to allow for the fact that most joists are set 16 in. on centers. The screws that are used in the edges where laths alone are available should be from 4 to 6 in. apart.

Order the ceiling cloth from a tent or awning shop, allowing an extra foot each way. For a 14 by 15-ft. ceiling, order a 15 by 16-ft. cloth. Have the seam double stitched as a *standing* seam, not with two stitches along either edge of a flat seam. The usual price for this work in the city where I live is five cents a square foot, stitched and delivered, for an extra wide, ceiling grade of unbleached muslin.

Have the cloth made up at least a week ahead of the time you wish to use it. Specify that it is to be clean and free of shelf dust lines on the bolted cloth. If any dust lines should appear, they must be



Applying a wall-board patch to a weak section of a ceiling to prevent any more plaster from falling



Using a straightedge to test the underface of the furring strip to insure a true line



Calcimine should be applied in small areas having an irregular edge. Two years after the first treatment, it is washed clean; two years later, it is recoated with half-strength calcimine

To aid in stretching the cloth, a T-shaped wooden pushing rod is used with points in the upper edge, which is beveled to fit snugly up into the corner

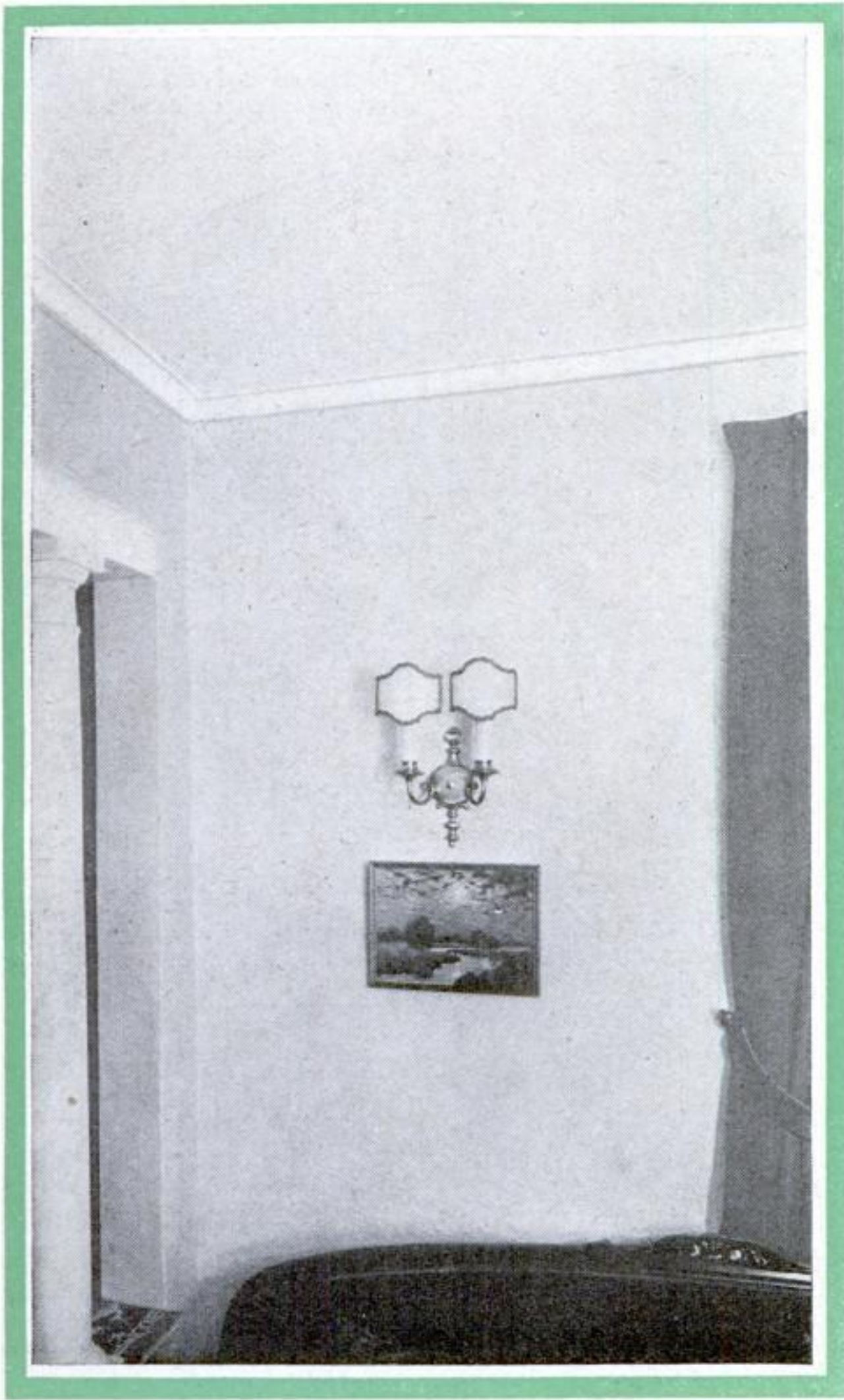
removed with a soft gum eraser or the soft core from a loaf of rye bread.

While the cloth is being made up, obtain some 1 by 2-in. white pine lattice stock, surfaced on four sides, and enough strips of 3-in. soft pine cove molding to trim the entire ceiling. For a 14- or 15-ft. run, buy 16-ft. lengths to allow for mitering, coping, or trimming. Get about a dozen wooden shingles to

be used as shims or wedges in lining up the 1 by 2-in. stock. If there are any ceiling light fixtures or furnace registers, material for these must also be provided. Use a solid circular board for the lighting fixture and 1 by 2-in. stock for a frame around the register opening.

Starting with the longest and best conditioned side of the room, apply a piece of the 1 by 2-in. wood, cut $\frac{1}{4}$ -in.

to Modernize Your Home



The completed balloon ceiling is of fine appearance—flatter and more perfect than the best plaster. It never cracks or falls

short, to the ceiling and nail into place with 10- or 12-penny nails. Use a 6 to 10-ft. straightedge as shown in one of the illustrations to insure that the lower face of the strip remains straight and true throughout its length. Whenever necessary, cut off 3-in. portions of the cedar shingles and use them as wedges to force the strip down level and afford solid nailing. The nails should not be more than 18 in. apart. Check frequently with the straightedge throughout the work, otherwise the cove molding will not finish tightly against the cloth.

Continue nailing the 1 by 2-in. stock around the entire ceiling. Be sure that the butt joints are solid and level. Next lay out the frames for registers and ceiling-light fixtures. Use the straightedge to test both crosswise and lengthwise. Level out with shingle shims where required.

Measure from the longest side to the center of each end of the room. Open up the cloth on the freshly swept and dust-mopped floor so that the standing center seam is on the upper face, nearest the

old plaster ceiling. Take up one end of the seam, walk up the ladder, and while a helper holds the cloth from a second ladder or on a suitable plank arrangement, use 6-oz. cut sign tacks (not round) to tack the cloth seam on the center mark, leaving some 3 in. of slack cloth against the wall. Tack several places on either side of the seam about 4 in. apart to hold the cloth. Go to the opposite end of the room with your helper and tack the other end of the seam to the center mark on the 1 by 2-in. strip while the seam is stretched as tight as is humanly possible.

Return to the first portion and tack the remaining half of the end towards the longest and straightest side, spacing the tacks about 2-in. apart and as near the wall as practicable. See that the slack cloth is kept on as even a margin as possible to insure straightness of the center seam. Continue the work along the straight wall. One man should align and stretch the cloth evenly, and the other do the tacking. It will be an advantage to have some one watch the center seam during the work, since if this is kept straight the other portions seem to take care of themselves more readily. As soon as the long wall has been tacked, return to the first end wall and finish the second half of that portion, thus completing one long side and one end.

The real work now begins. Considerable strength of fingers and arms is required to stretch the cloth endwise while some one else does the tacking. To overcome the strain on fingers and forearms, I devised a stretcher something like the old carpet stretcher of our grandparents' day. A 6-ft. length of 1 by 3-in. pine was used as the rod, (*Continued on page 117*)

HOW TO RESTRETCH UPHOLSTERY WEBBING

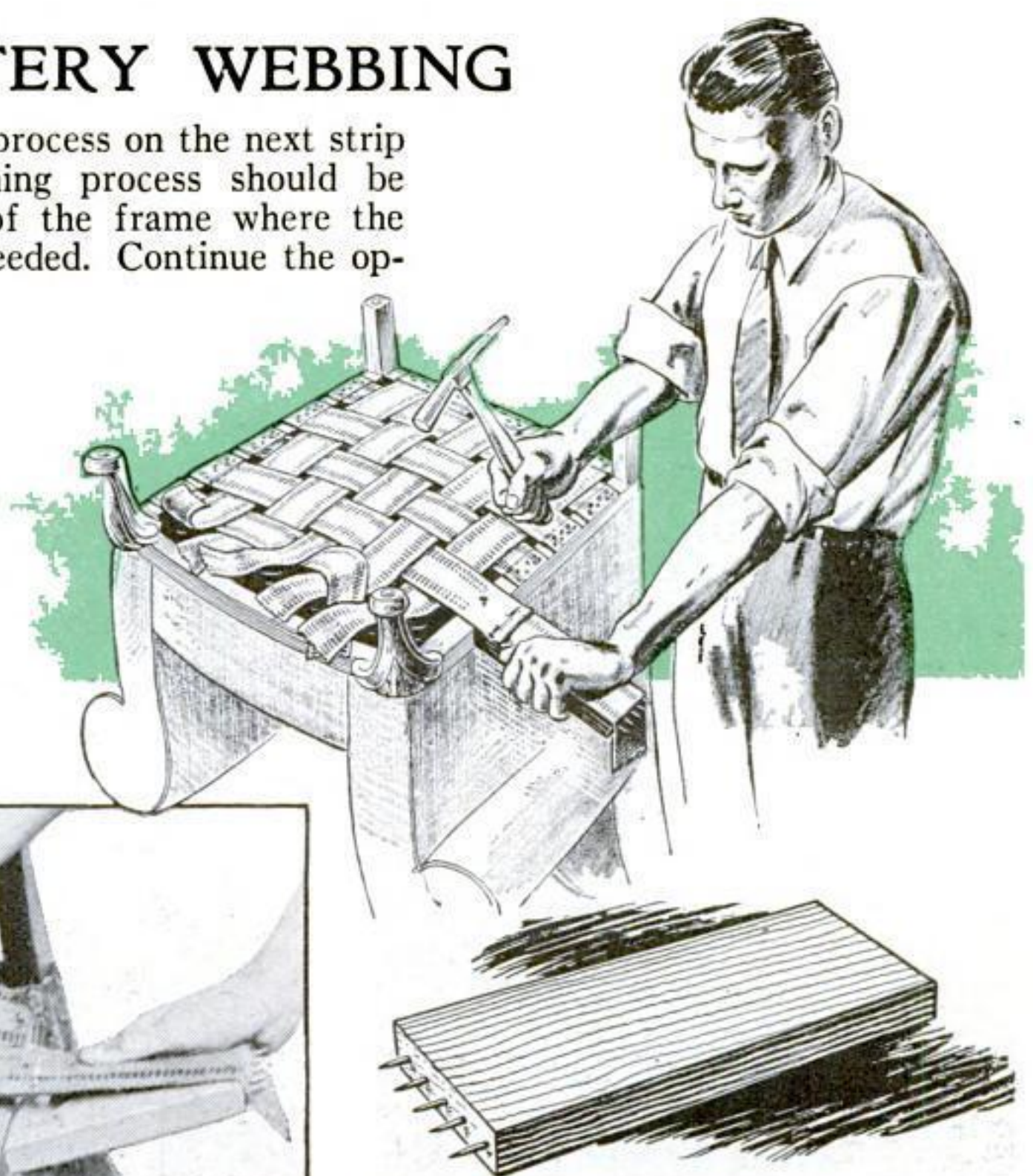
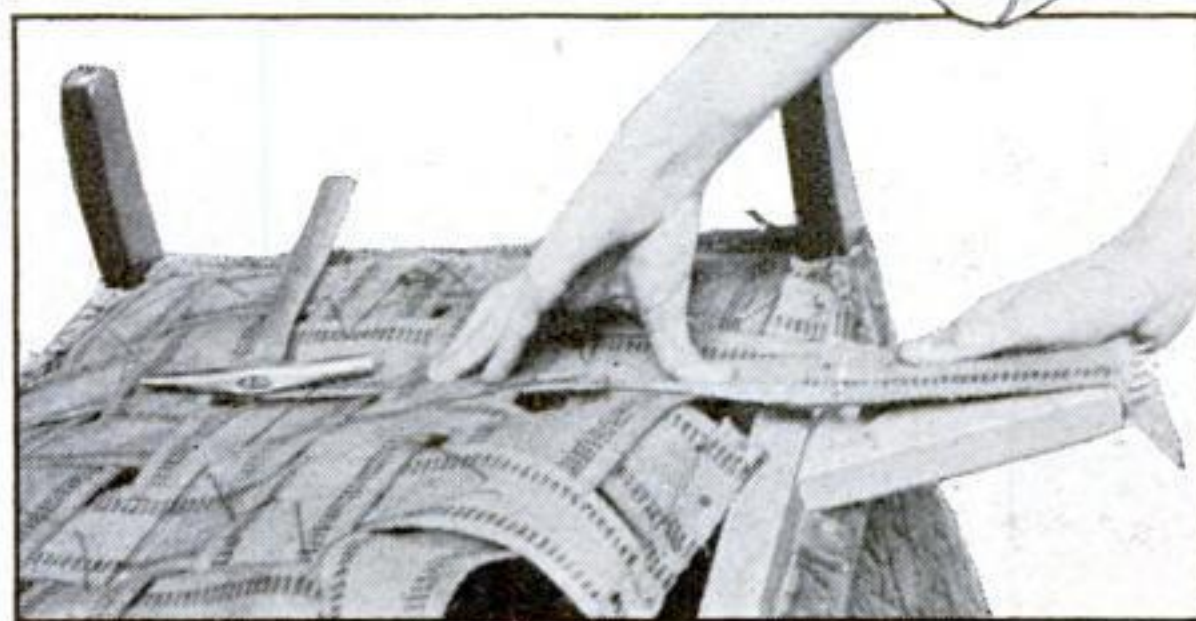
WEBBING, which is the foundation of all upholstery work, occasionally comes loose on a piece of furniture.

Remove the black cloth that is tacked over the webbing; also remove the covering material on the bottom of the furniture. Retack one end of each loose piece of webbing. Use 12-oz. upholstery tacks or $\frac{3}{4}$ -in. wire nails, staggering them so as not to split the frame.

A webbing stretcher is required for the next operation, and it can be made from a piece of wood about 4 in. wide and 8 in. long. Drive five nails part way into one end of the wood, cut off the nailheads, and file the ends to a point.

In order to use the stretcher, an extra strip of webbing or a piece of heavy canvas about 4 in. wide and 12 in. long is necessary. Use large nails to pin this piece to the loose end of a strip of the old webbing on the furniture. Put the end of the stretcher against the frame, and hook the loose end of the extra strip through the nails in the stretcher. Then pull down as illustrated. Tack the stretched webbing to the frame, remove the

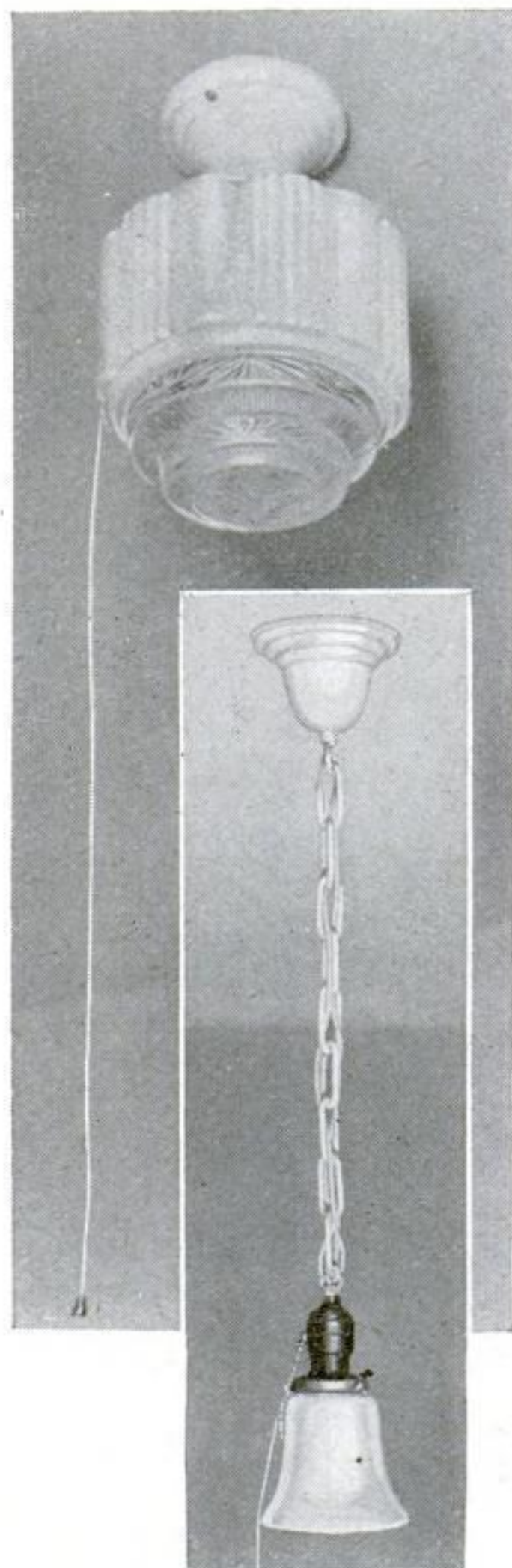
loose strip, and repeat the process on the next strip of webbing. This stretching process should be started towards the rear of the frame where the least amount of strain is needed. Continue the operation to and at the front of the furniture, as shown. Finally, replace the edges of the covering over the webbing and tack a piece of black cambric over the webbing, folding in the edges all around. The cambric catches dust before it falls to the floor.—HERBERT BAST.



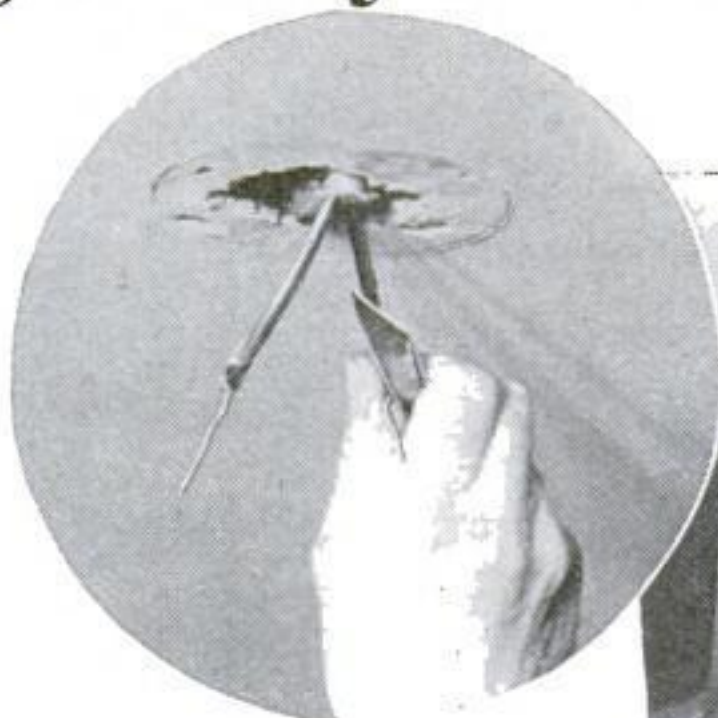
The webbing is tightened with the aid of a stretcher and a short piece of old webbing

Installing a Crystal-Bottom Kitchen Light

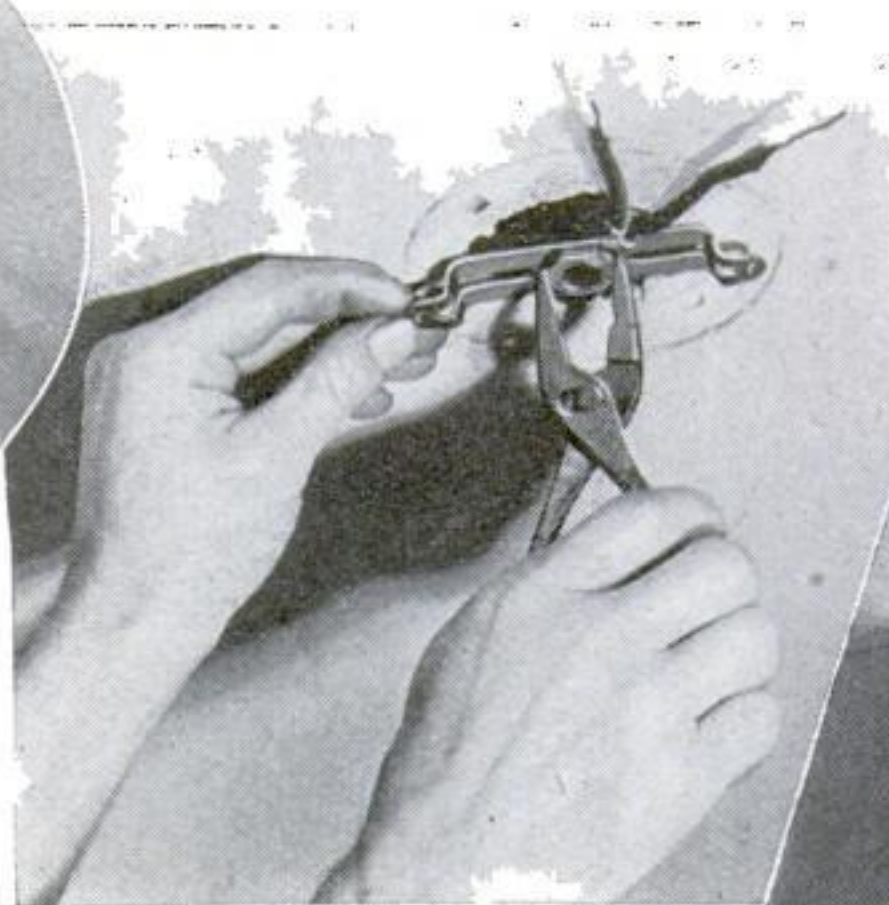
By HAROLD P. STRAND



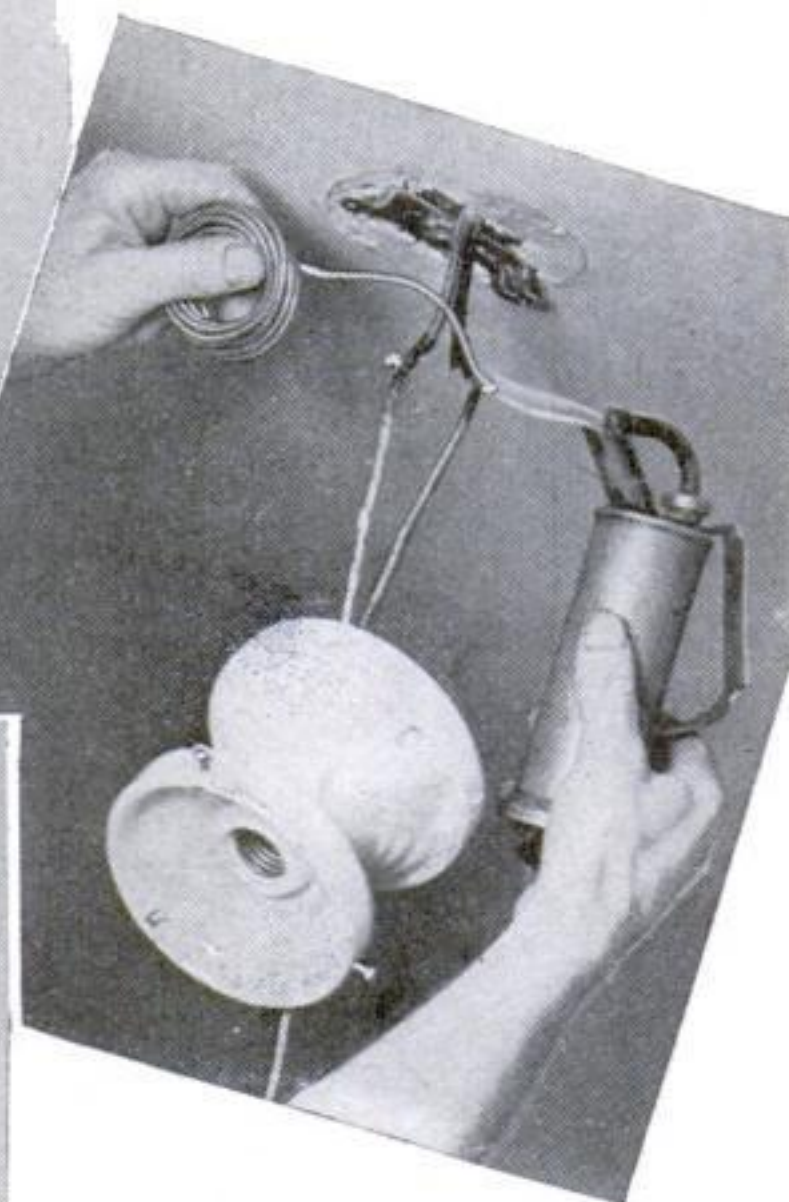
The modern ceiling kitchen unit, shown at top, provides strong but evenly diffused illumination throughout the room. It is far superior to the old-fashioned pendant which it is displacing



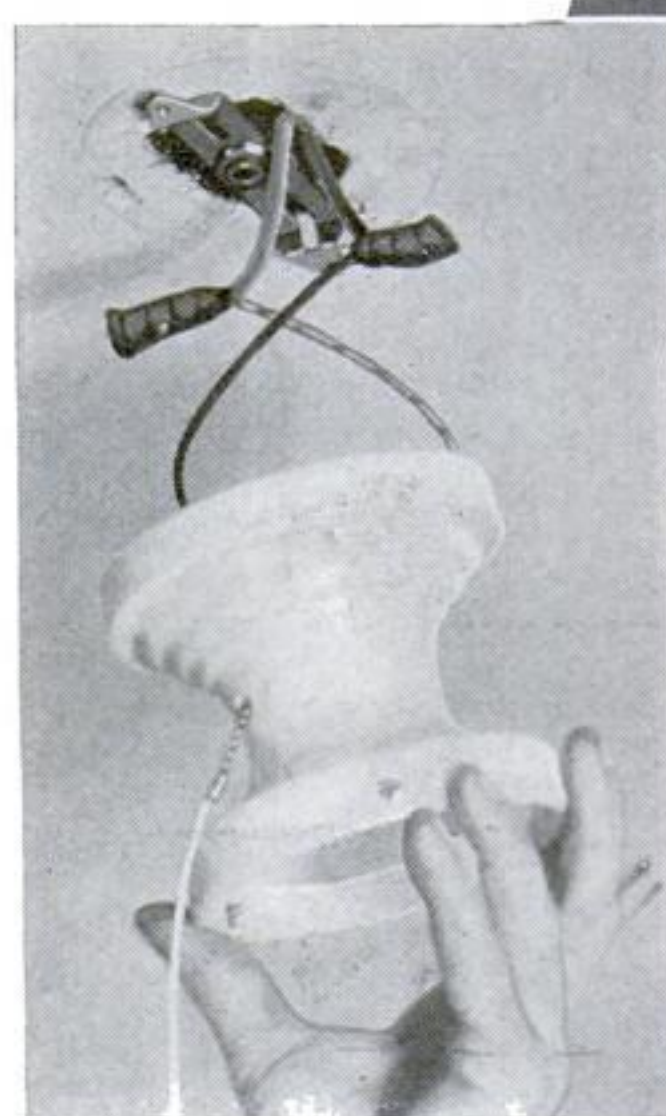
After the old pendant has been removed, the ends of the wires are scraped clean; then the fixture bar is secured with a lock nut as illustrated at the right



The wires are twisted tightly, the ends bent over to prevent puncturing the tape, and the joints soldered as below with a small torch or soldering iron



At left the joints have been taped, the old holes in the plaster patched, and everything made ready to fasten the holder with two machine screws



ONE room where the housewife always appreciates good illumination is the kitchen. Here she does most of her work, and good light certainly is an aid.

The modern way of lighting the kitchen is with a crystal-bottom ceiling unit containing either a 75- or a 100-watt lamp. This type of fixture provides a strong but evenly diffused source of light that helps make working a pleasure. In addition it reduces eyestrain to the minimum. The bottom of the globe is a cut or molded form of glass that is clear, but the nature of the design breaks up the light rays, thus preventing an objectionable glare. If a table happens to be under the fixture, this strong light directly downward is very useful. The rest of the globe is composed of opal glass, which spreads a soft but adequate light throughout the entire room, including even the corners.

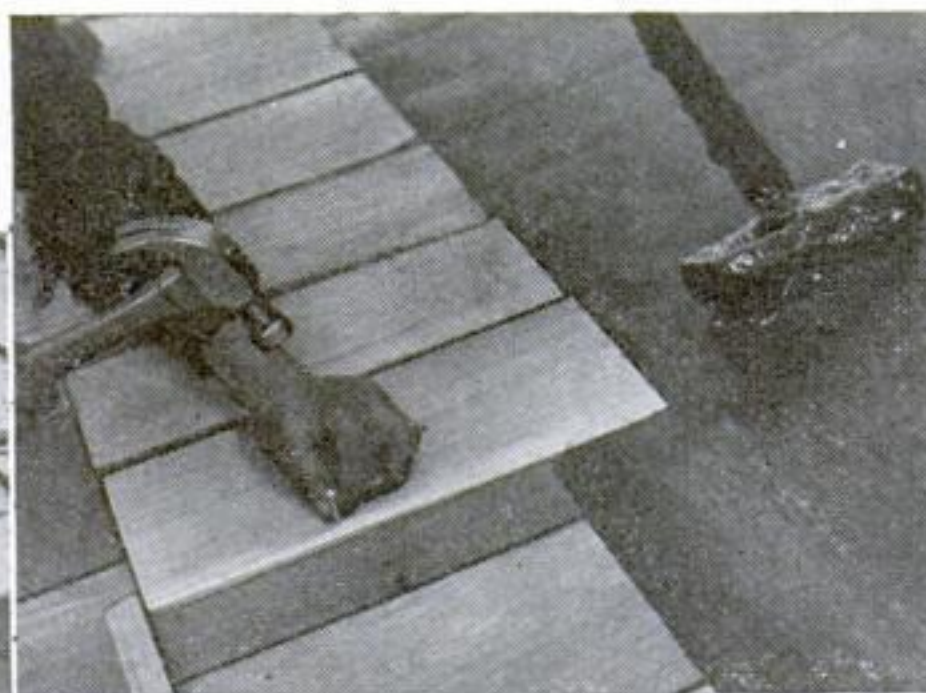
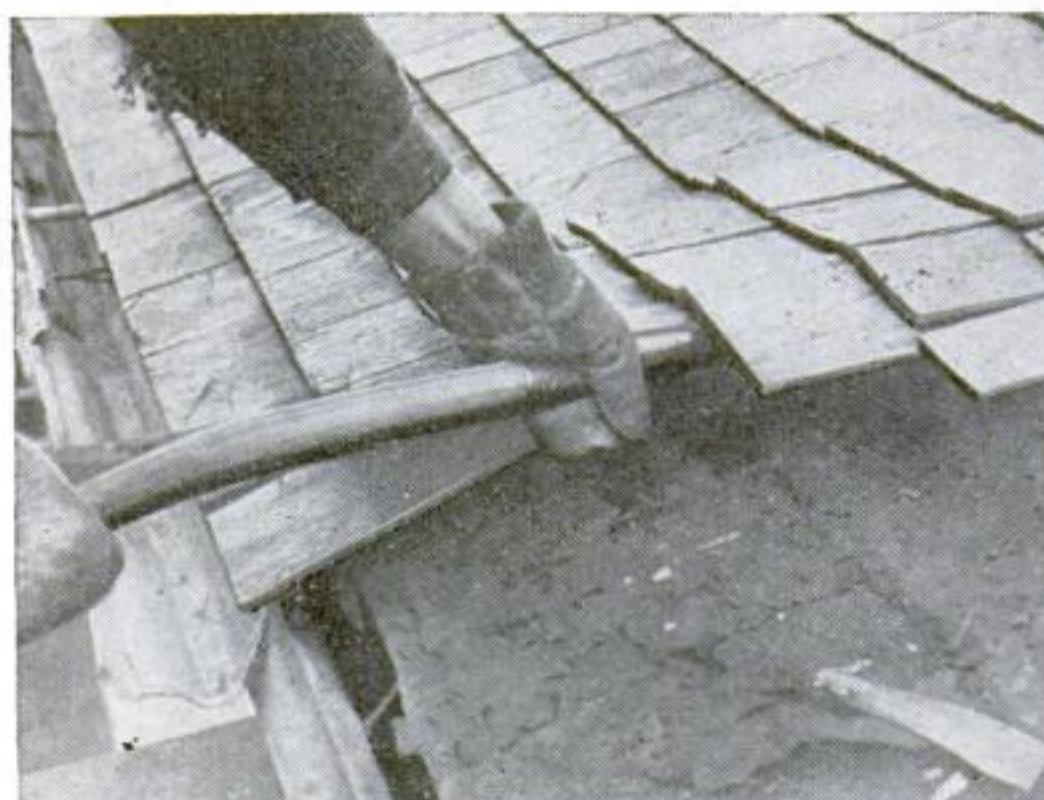
To install one of these units, remove the old pendant and scrape the ends of the wires that come from the outlet box until they are clean and bright. In the case illustrated there is an outlet box which was imbedded in the plaster when the house was built, and it has a $\frac{3}{8}$ -in. fixture stud in the center. In older houses one is likely to find a combination outlet in which a [\(Continued on page 119\)](#)

STOPPING LEAKS IN SHINGLE ROOFS

IN NORTHERN districts, particularly during a severe winter, many roof leaks are reported, all similar in cause and usually occurring in houses and other buildings where the roof projects considerably beyond the walls at the eaves. This type of leak is always prevalent in seasons of heavy snowfall and is likely to cause much damage to ceilings and walls.

On a comparatively mild day, the snow on the main part of the roof melts because

of the sun and the warmth of the building. As the water runs down the roof, it is likely to freeze on the wide overhang because this portion of the roof is much cooler, being more exposed to the wind and having no warmth from below. Gradually a ridge of ice forms, [\(Continued on page 123\)](#)

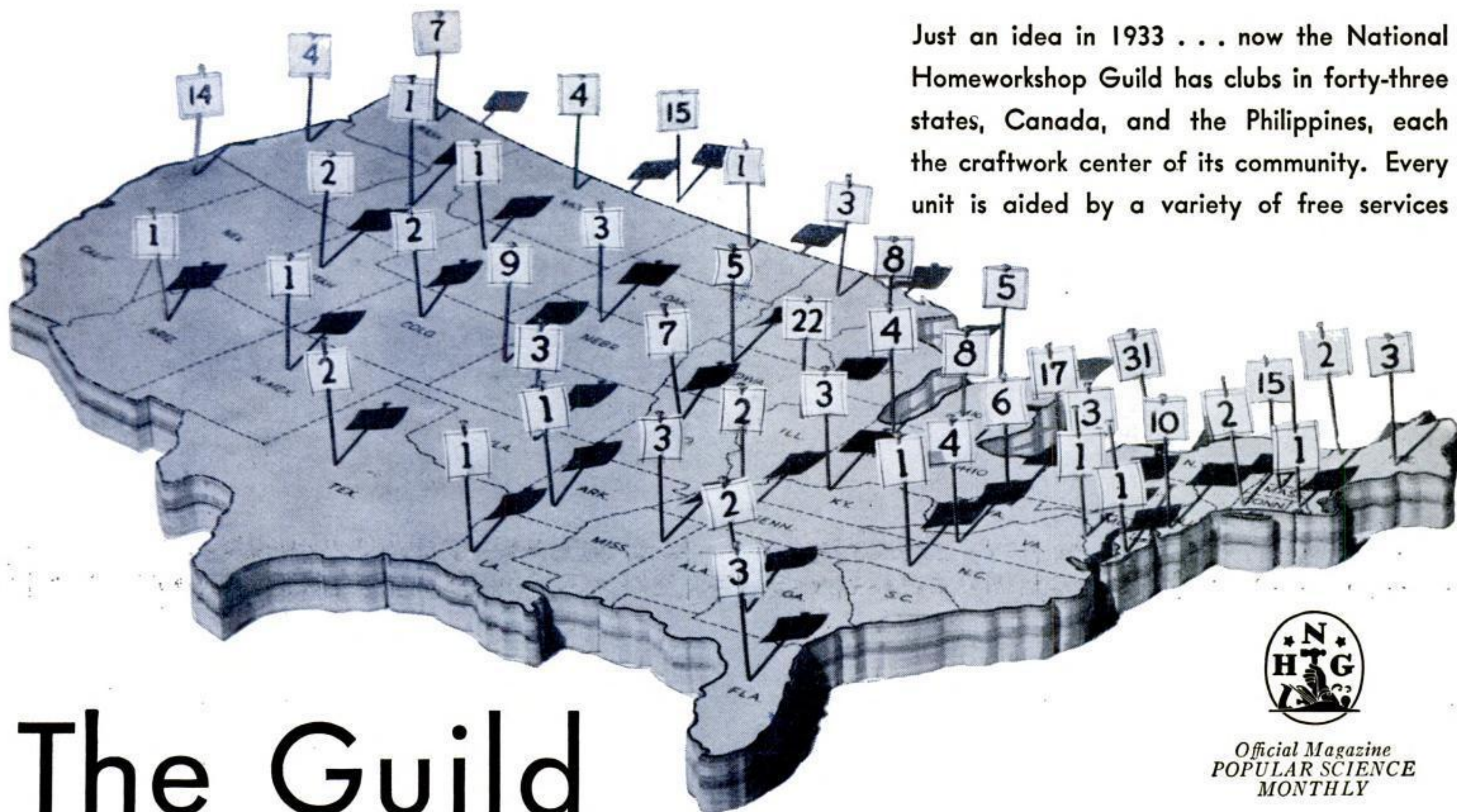


The shingles are removed along the edge of the roof with the aid of an old spade as illustrated at the left. Above: Laying new shingles on roll roofing covered with roofing cement

A Dozen Suggestions for MARCH Jobs

HERE are twelve shipshape-home ideas for March, any of which will aid in making your house more modern and livable:

- Repair furniture and upholstery.
- Build cabinet for children's toys.
- Correct sagging doors or defective windows.
- Rearrange the kitchen for more efficient work.
- Add handrail for cellar stairs.
- Install full-length mirrors on bedroom doors.
- Repair or replace defective locks, chains, or bolts.
- Weather-strip cracks around window sash and doors.
- Lay flooring for any unfinished part of the attic.
- Construct built-in telephone cabinet.
- Replace common glass with ultraviolet-ray glass in nursery or sun porch.
- Insulate roof or attic floor to reduce heat losses in winter and to make house cooler in summer.



The Guild Aims to Cover the Map

ROLL CALL OF CLUBS IN THE GUILD

ARIZONA Tucson	S. effield Springfield
ARKANSAS Little Rock	Waukegan Western Springs
CALIFORNIA Antioch	INDIANA Borden
Auburn	Evansville
Bellflower	Fort Wayne
Glendale	Terre Haute
Huntington Park	IOWA Cedar Rapids
Los Angeles (Model R.R.)	Creston
Newcastle	Des Moines
Oakland	Emmetsburg
Pasadena	Mason City
Reseda	KANSAS Fort Leavenworth
San Diego	Fowler
San Jose (2)	Gaylord
Santa Monica	Holton
COLORADO Denver	Kincaid
Pueblo	Smith Center
CONNECTICUT Middletown	Topeka
Putnam	Wichita
DELAWARE Wilmington	Winfield
DISTRICT OF COLUMBIA Washington	KENTUCKY Covington
FLORIDA Jacksonville	Lexington
Miami	Louisville
Ocala	LOUISIANA Shreveport
GEORGIA Atlanta	MAINE Biddeford
Lake Park	Brunswick
IDAHO Nampa	East Machias
ILLINOIS Chicago (5)	MARYLAND Baltimore
Cicero	Boonsboro
Decatur (2)	Hyattsville
Dixon	MASSACHUSETTS Boston (Model R.R.)
Elgin	Brockton
Elmhurst	Fall River
Freeport	Lawrence
Galesburg	Longmeadow
LaGrange	Lowell (2)
LaSalle	New Bedford
Mount Morris	North Adams
Peru	Orange
Rockford	Roxbury (2)
	Springfield
	West Lynn
	Worcester

(List continued on page 113)

WITH HOME WORKSHOP CLUBS

GRAPHICALLY illustrated on the jig-sawed map above is the distribution of home workshop clubs throughout the United States. Each flag bears the number of active clubs in the state in which its pin is implanted. There are clubs in forty-three states, besides Canada and the Philippines, at the time this is written, and clubs are continually being organized. New York has the most clubs; Illinois is second.

A home workshop club in every town is the ultimate goal of the National Homeworkshop Guild. Interest in the hobby is increasing steadily, so the Guild directors see no reason why this mark cannot be reached. More than 100 new clubs were organized last year under the Guild's free membership plan, and at least 200 are expected to become affiliated with the organization during 1937.

The majority of the clubs are in the more densely populated areas, but home workshop enthusiasts living in the smaller towns are beginning to discover that they, too, can double the pleasure and satisfaction they get out of their hobby by forming groups and affiliating with the Guild. A complete list showing where clubs are located begins on this page. If more than one club is situated in a town, the number is given in parentheses.

Each new club becomes the craftwork center of its neighborhood or community. The members, instead of having to work entirely alone, meet regularly to talk over their problems, to watch woodworking, model making, metal working, painting,

and other demonstrations, and to participate in a great variety of actual constructive projects. Not all of this is done for purely personal reasons, either. Many of the clubs get experience in craftwork and gain much enjoyment from such group undertakings as making toys for poor children, aiding dramatic clubs in the construction of scenery, helping the local manual training classes by offering prizes for meritorious work, and building equipment for various organizations. A notable example of the latter type was the construction of a cabin for Boy Scouts by the Rockford Homecraft Club (see P.S.M., Jan. '37, p. 98). (Continued on page 113)

HOUSE REPAIRS Is Club Topic for March



HOME workshop club members will learn a lot of new ideas about keeping their homes shipshape as the result of a special demonstration and discussion scheduled by the Guild's Program Service Bureau for March. This is the fourth in the series of special monthly events planned by Guild experts and outlined in the regular Guild bulletins sent to club secretaries.

The February program feature—a crossword puzzle composed largely of shop terms—has aroused much interest because of its novelty. Such stunts always help make club meetings more enjoyable.

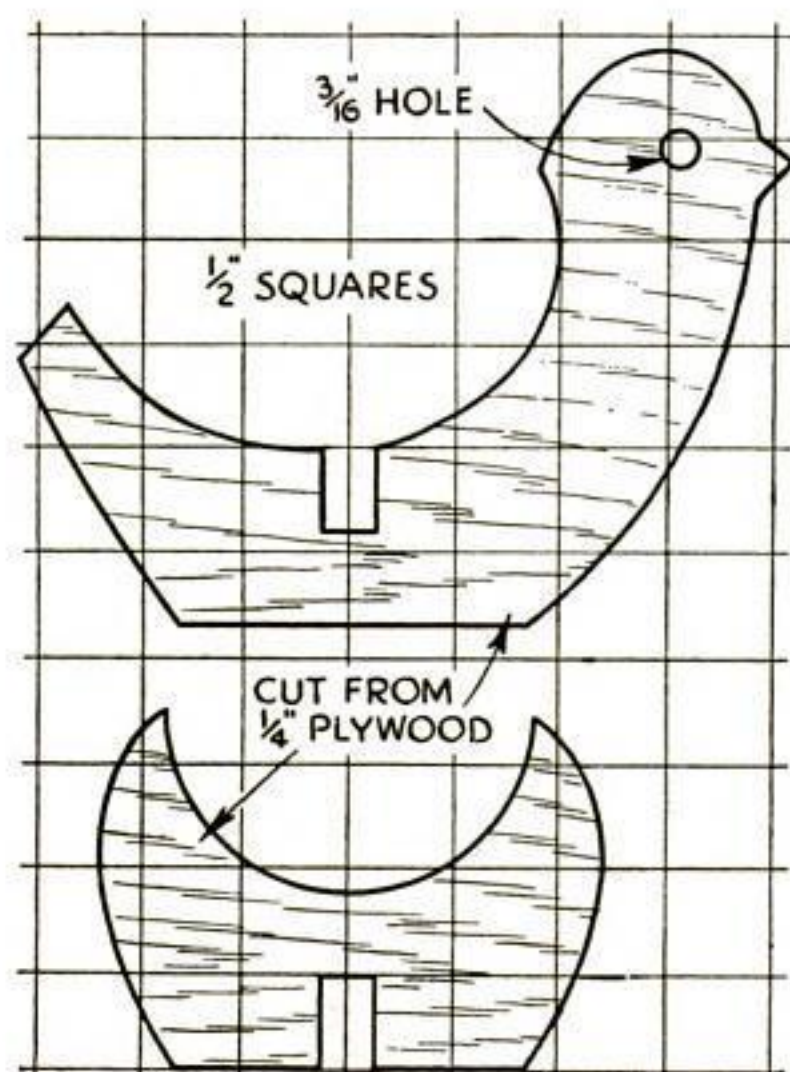
UNIQUE EASTER EGG HOLDERS JIG-SAWED FROM PLYWOOD

HERE is a decorative Easter egg holder easily and quickly made from two pieces of plywood. The secret of its construction is shown in the diagram, and the finished holder appears as in the photograph.

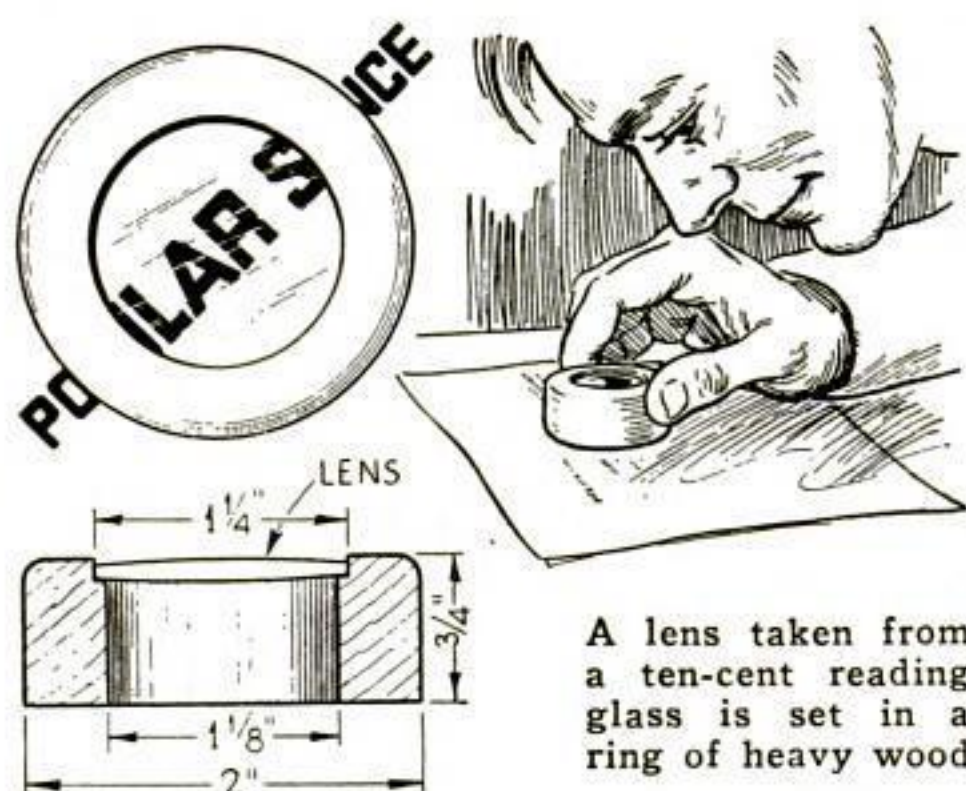
Plywood $\frac{1}{4}$ in. thick, of any inexpensive variety, is suitable. It may be sawed with either a power-driven jig saw or a hand fret saw.

Prepare a full-size outline of the two pieces by sketching them on a piece of heavy paper on which $\frac{1}{2}$ -in. squares have been drawn. Cut out the two designs with a pair of scissors, lay the patterns on the plywood, and outline the shapes with a pencil. Two or more holders may be sawed out at the same time by tacking together two or more pieces of plywood. In sawing out the slots, be sure they are the right width to form a tight fit when the two pieces are engaged. The eye is indicated by boring a $\frac{3}{16}$ -in. hole.

Yellow paint or enamel will give a pleasing effect to the finished holders, and only the addition of an egg with the customary brilliant dyes of many hues is necessary to complete this Easter novelty.—GEORGE A. SMITH.



Painted a bright yellow, the holder supports a gayly dyed egg at the Easter breakfast table. The patterns are at the left



A lens taken from a ten-cent reading glass is set in a ring of heavy wood

WOODEN PAPER WEIGHT HOLDS DESK MAGNIFIER

A COMBINATION magnifier or reading glass and paper weight that will be a useful accessory on any desk may be made as shown above. The block of hardwood is either turned on the lathe or cut out on a jig saw and shaped by hand. The glass should fit tightly in the rabbet and may be cemented in for additional security. A ten-cent reading glass of suitable size for this purpose is sold in chain stores, and it can quite easily be removed from its handle.—D.W.C.

MODEL RAILWAY FOLIAGE MADE FROM RUBBER

As soon as boys—not to speak of their fathers—have found out all there is to know about operating a new model railway, they usually want to build realistic scenery for it and put in a number of miniature trees. For making the foliage, I have tried everything that looks green and find a green sponge-rubber bath mat is best if it is cut into very small pieces, match-head size. A small pile of these is kneaded together with a high-grade rubber cement, then applied to the end of a small twig and modeled into a natural tree shape.—JAMES A. LAVERTY.

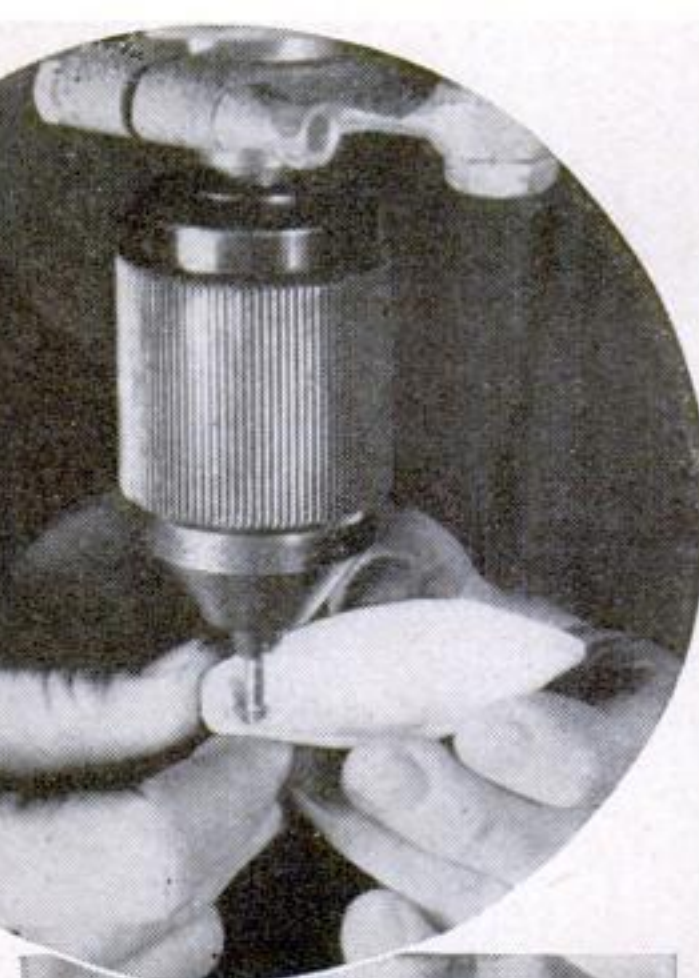
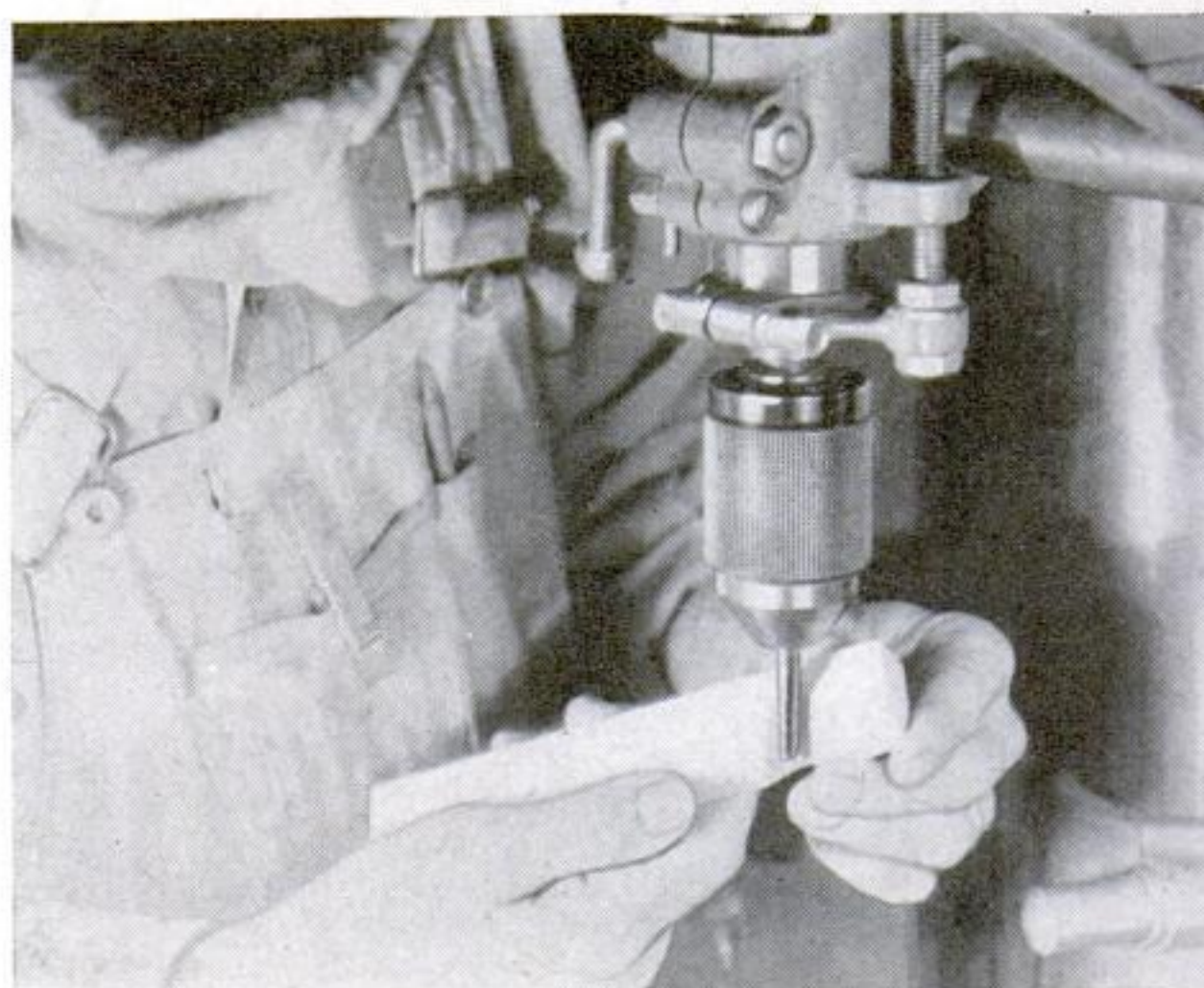
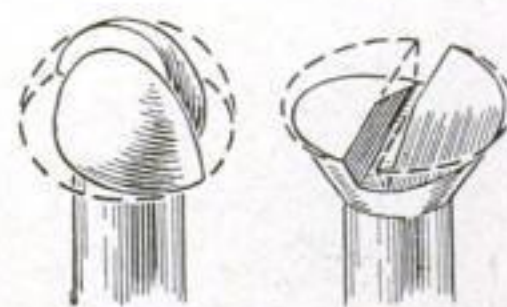
NEW TOOLS FOR YOUR DRILL PRESS

MODELS and other work may quickly be carved by the use of a tap in a drill press. Whirling at highest speed, the toothed flutes remove stock at a surprising speed, and cut across the grain without splintering. Scratches left in the work are soon removed with small reamers used in the same way.

For inside work, as in hollowing a lifeboat or other small piece, a quick job is done with a roundheaded wood screw held in a chuck on the drill press or lathe. To provide proper clearance, file away the side of the slot not used for cutting. A flathead screw treated in the same way makes an efficient routing cutter.

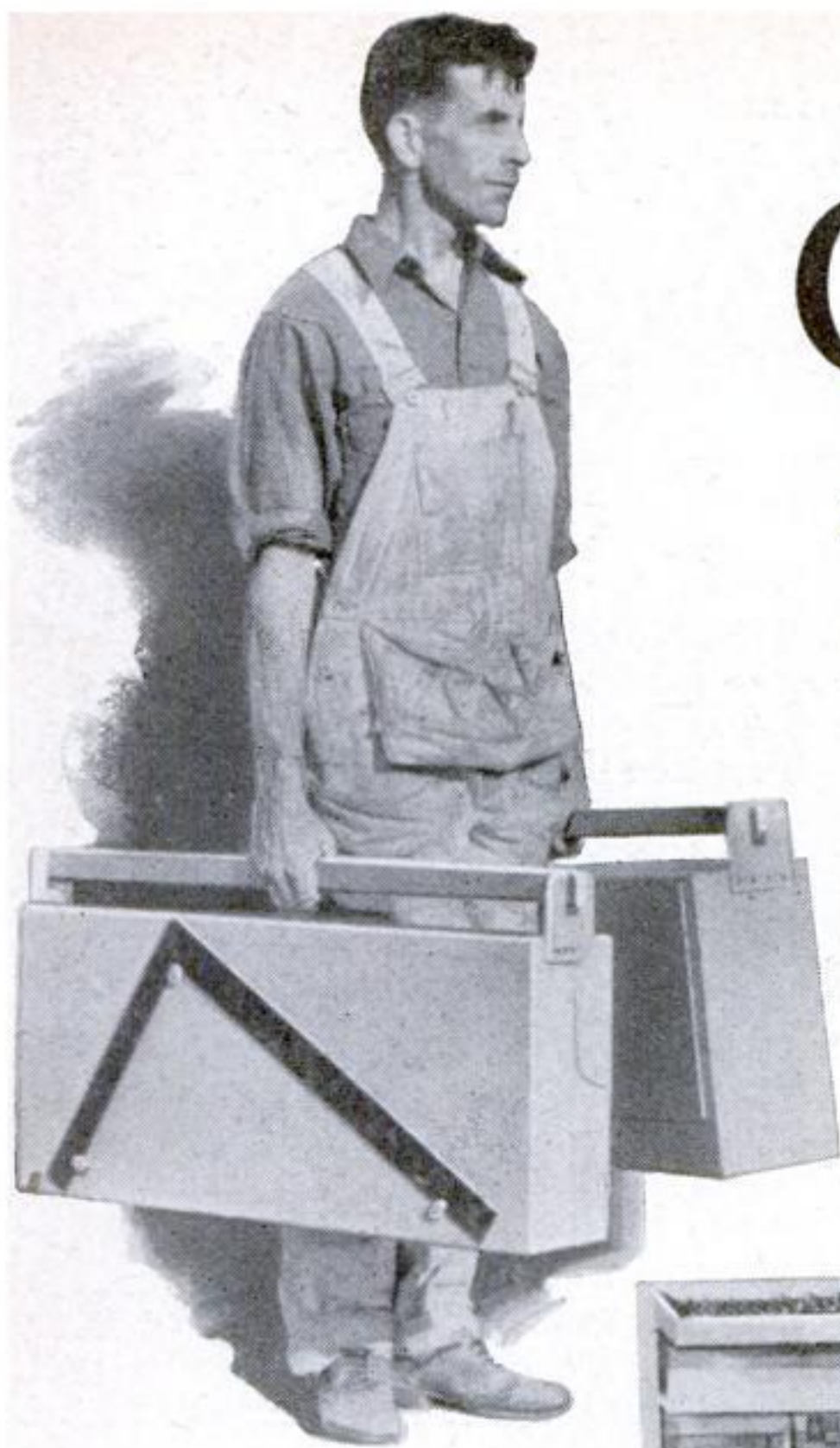
Very small dowel rods, useful for stanchions and railings, may be made by rotating hardwood meat skewers or $\frac{1}{4}$ -in. doweling at highest speed in a drill chuck and forcing one or more dies over it.

Hollowing a model lifeboat with modified roundhead screw



Small spindles and stanchions may be turned from wooden meat skewers and dowels with the aid of inexpensive threading dies

A tap, gripped in the drill-press chuck and whirling at high speed, is a good carving tool



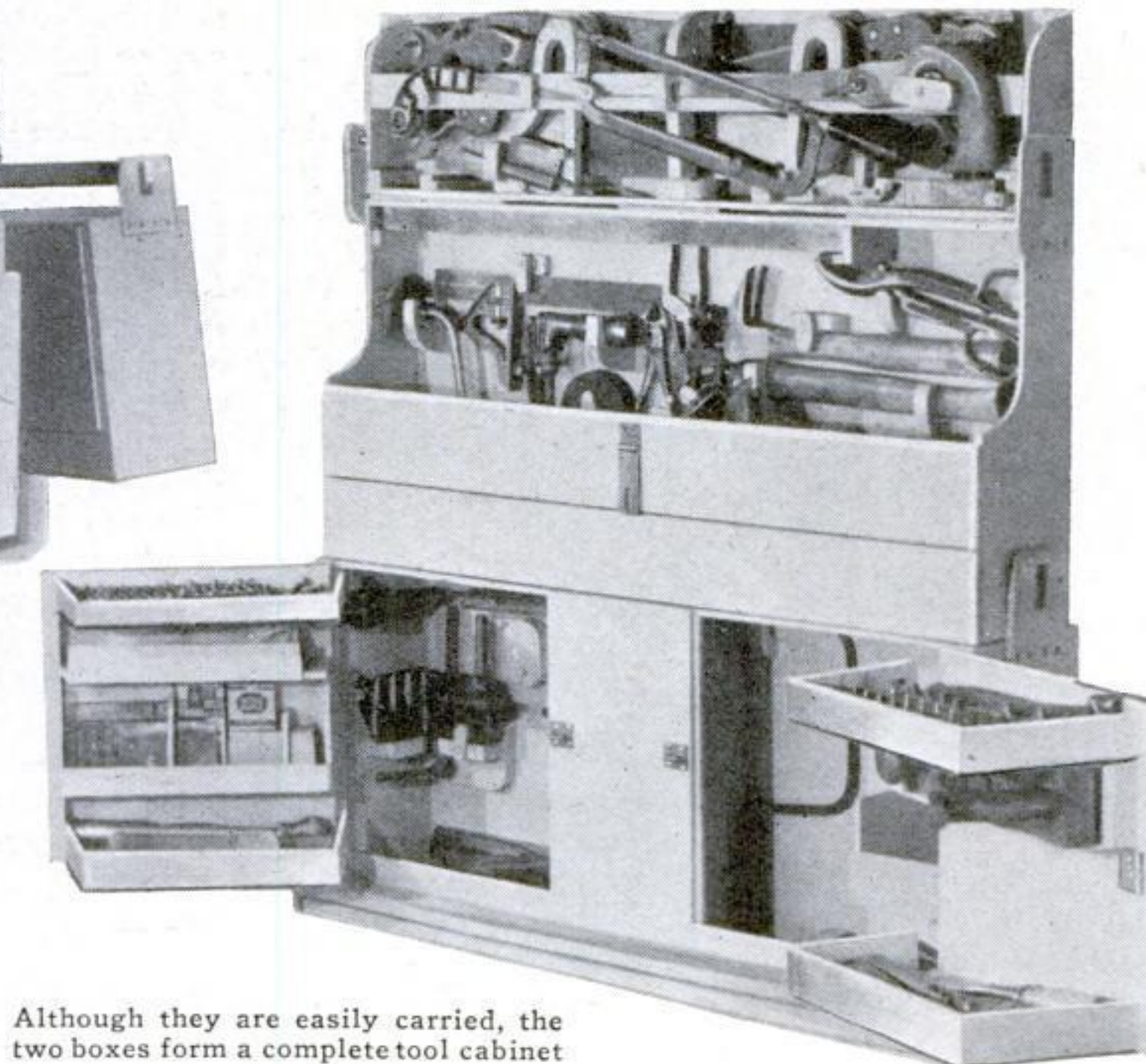
IMPROVED Carpenter's Boxes

HAVE A PLACE FOR EVERY TOOL

By Edwin M. Love

THE average carpenter's tool box is hard to keep in order. Whether it is a large chest, a shoulder box such as is carried to the job, or the open hand box so often used because of its portability, it is next to impossible to keep the tools handy or to make a quick inventory of them. Even though trays or tills are usually provided, the upper tills must be removed to reach the lower ones, while tools in the bottom must be nested together with time-wasting care or they are hopelessly jumbled.

Designed to overcome these objections, the boxes illustrated are simple to construct and thoroughly practical. In them I carry all my carpenter tools, excepting, of course, the miter box. As soon as a box is opened, I can remove any frequently used tool without lifting another; and at quitting time one glance shows what tools are missing, for all are either silhouetted in



Although they are easily carried, the two boxes form a complete tool cabinet

dark paint or their places are labeled.

All rough tools are in one box, and the additional tools needed for finishing are carried in the second. If all the tools are required on the job, I set the finish box on the floor against a wall, place the rough box on top, and the two form a convenient cabinet where every tool, no matter how small, is at hand. For carrying, I close the boxes, slide the handles into place, and take one in each hand.

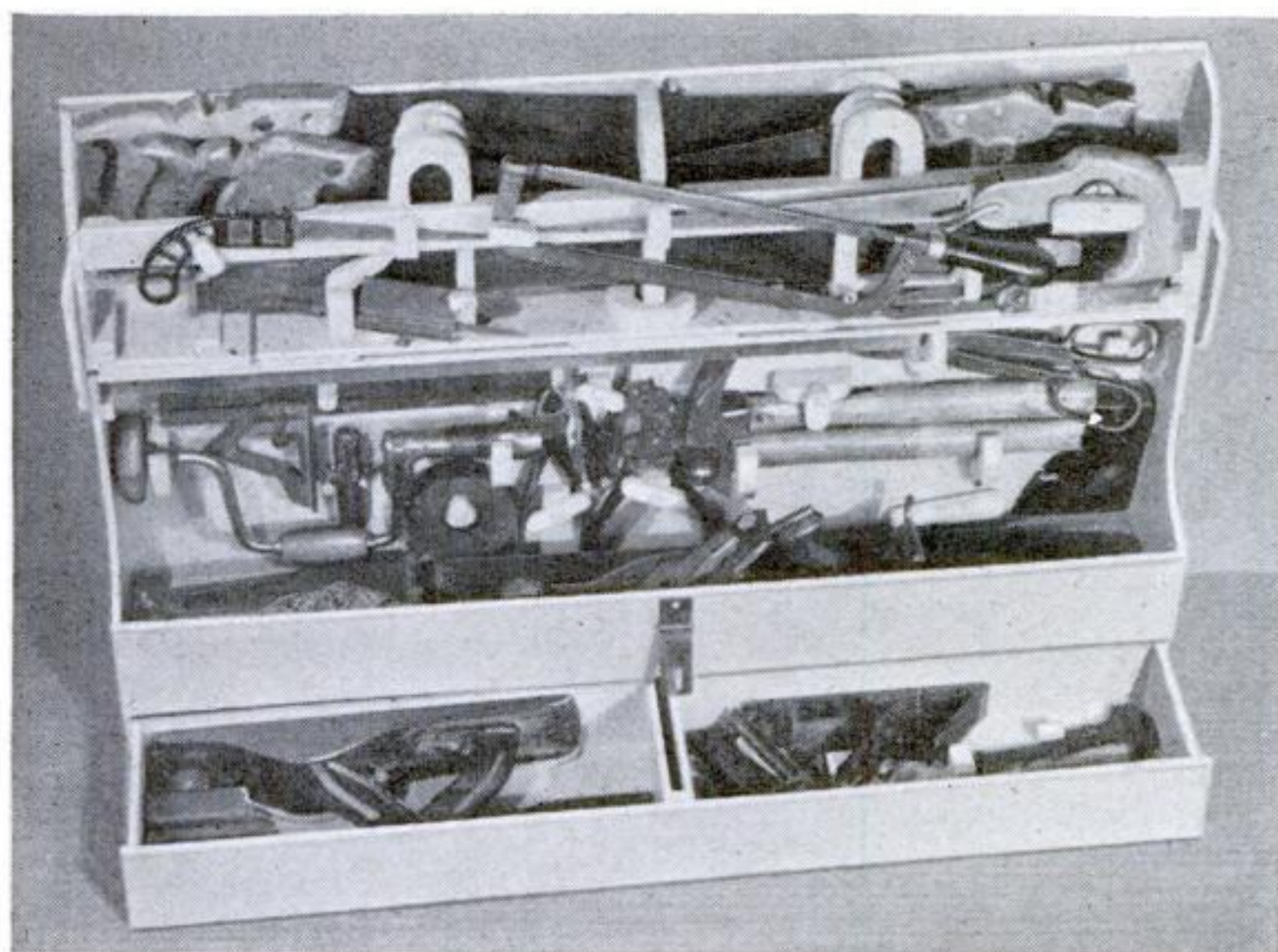
Placed face to face in the auto trunk, they form a compact unit.

Build the chests of $\frac{1}{4}$ -in. three-ply fir wall board, butting the joints and using both casein glue and brads. Note that the front of the drawer in the rough box extends full length, while the drawer itself is cut into two parts to straddle the partition. If a small hardwood block is glued in the front of this division and a hole is bored through the floor of the section above into it, the drawer can be locked by inserting a spike.

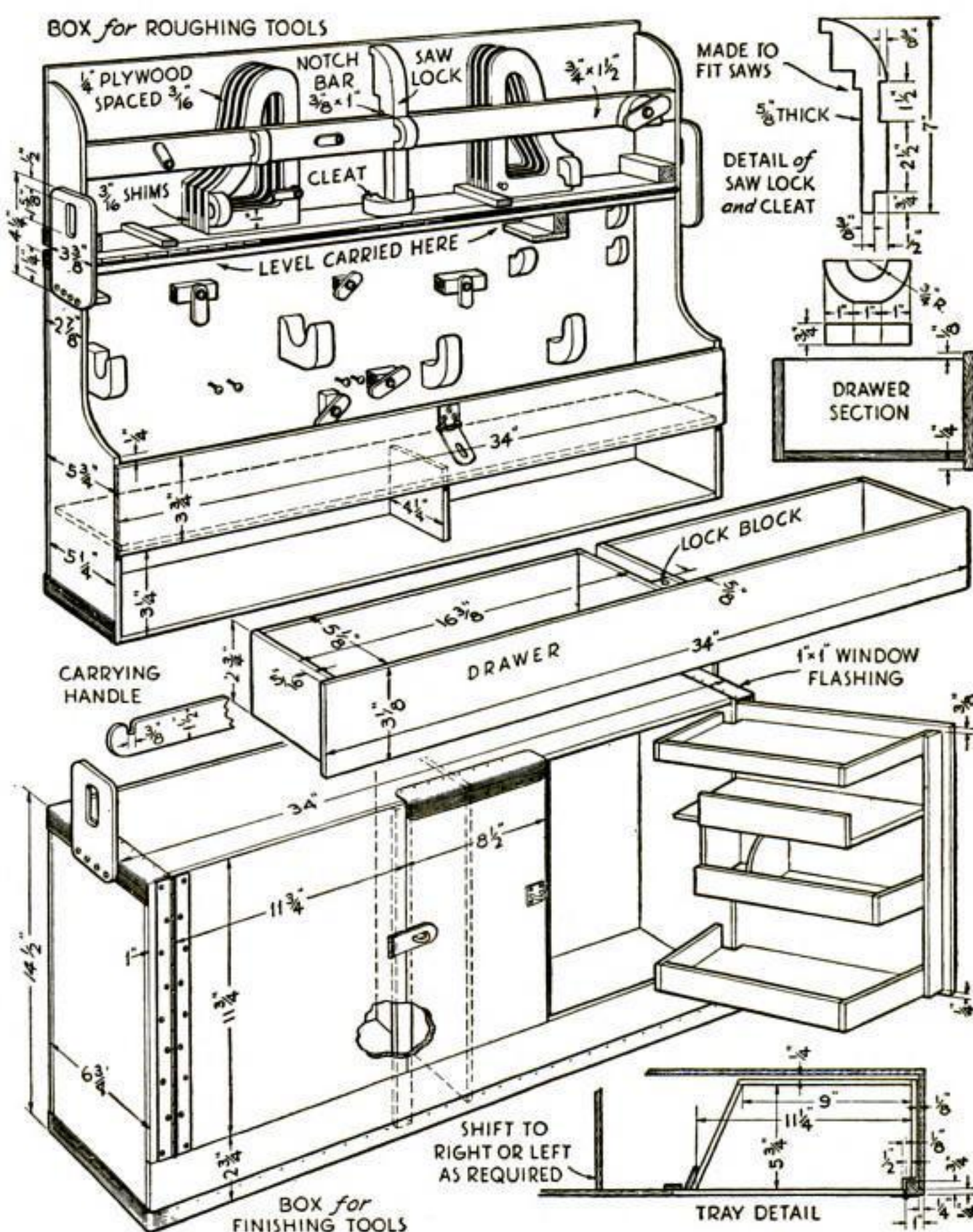
Bind the upper and lower corners with tin window flashings, driving $\frac{1}{2}$ -in. wire nails near the edges about every inch, and clinching them inside. Use piano hinges nailed in the same way. If you have no drill of the right size, the metal can be pierced with a center punch used first

from the front, then from the back.

There is space for three or four hand-saws in the lid. The plywood supports are cut away in the centers to give lightness. Their bases, [\(Continued on page 118\)](#)



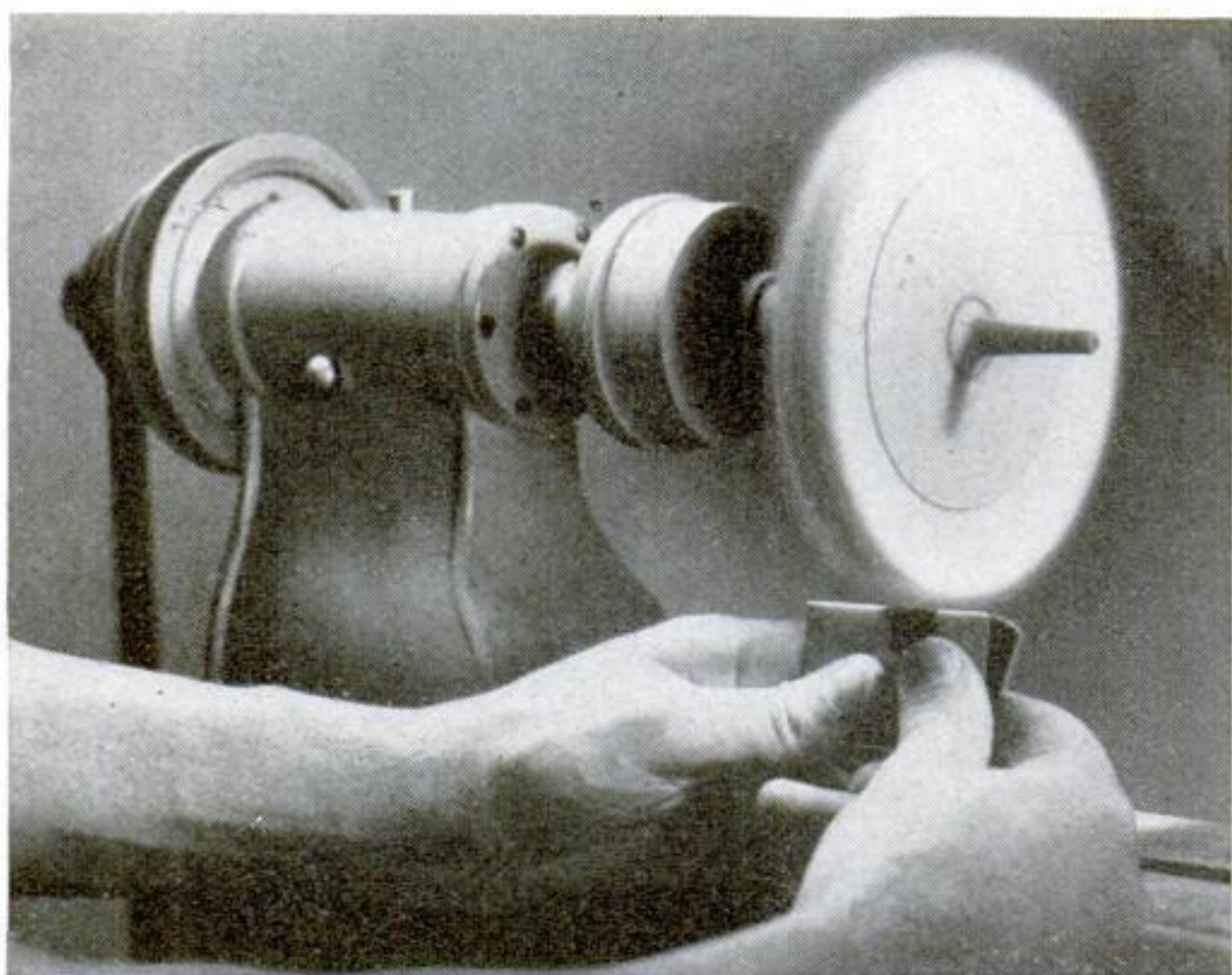
The box for the roughing tools. The drawer has been pulled out to show how it straddles the partition. General dimensions are given at the right



Homemade Spindle and Buffs

FOR METAL POLISHING

By Oliver Bandelier



A discarded muslin sheet provided the material for this buffing wheel, and the spindle which supports it was turned from wood

MANY home workshop owners finish small metal projects by hand, but it is a laborious and inefficient process. With an inexpensive spindle and a few buffing wheels, a high polish can be produced quickly and in a professional manner. Suitable spindles can be obtained for attaching either to an electric motor or to a lathe headstock or other power tools. For occasional use or in an emergency, you can make a satisfactory spindle from hardwood, and the buffs can be cut from old bed linen.

One of the photographs and the drawing show how the spindle is made. Place a $1\frac{1}{4}$ by 6-in. hardwood turning square in the lathe, round it, then taper the tailstock end down to about $\frac{1}{4}$ in. Cut a shoulder on the headstock end, as shown in the drawing. After removing the piece from the lathe, attach a faceplate with a 1-in. thick block screwed to it, and turn the block down to a diameter of $2\frac{3}{4}$ in. Then turn a hole in the face of the block to receive the large dowel left on the end of the tapered piece.

After gluing the wood spindle to the faceplate, center the small end with the tailstock and apply sufficient pressure to hold the two parts securely together while the glue is drying. Meanwhile you can slowly rotate the faceplate by hand and with a pencil draw lines for the screw thread. Cut the shallow threads with a hand scroll saw or coping saw, as shown in one of the photographs, and afterward widen the cut with a triangular file, followed by light sanding. Cut off the button remaining on the tapered end, and the spindle is finished, unless you should wish to add a single coat of shellac or varnish.

Three very satisfactory 6-in. buffs can be cut from one muslin sheet that would otherwise be discarded or used for rags. (Pieces of old flannel may be used in the

same way.) Cut the muslin into $6\frac{1}{2}$ -in. squares. Make a small hole in the center of the pieces so they can be slipped over a bolt. This may be done by folding three of the squares at a time so that the inside corner of the fold (and therefore the exact center of the cloth) can be snipped off.

The next step is to place the pieces in a jig, as illustrated, so they can be trimmed circular. First slip a

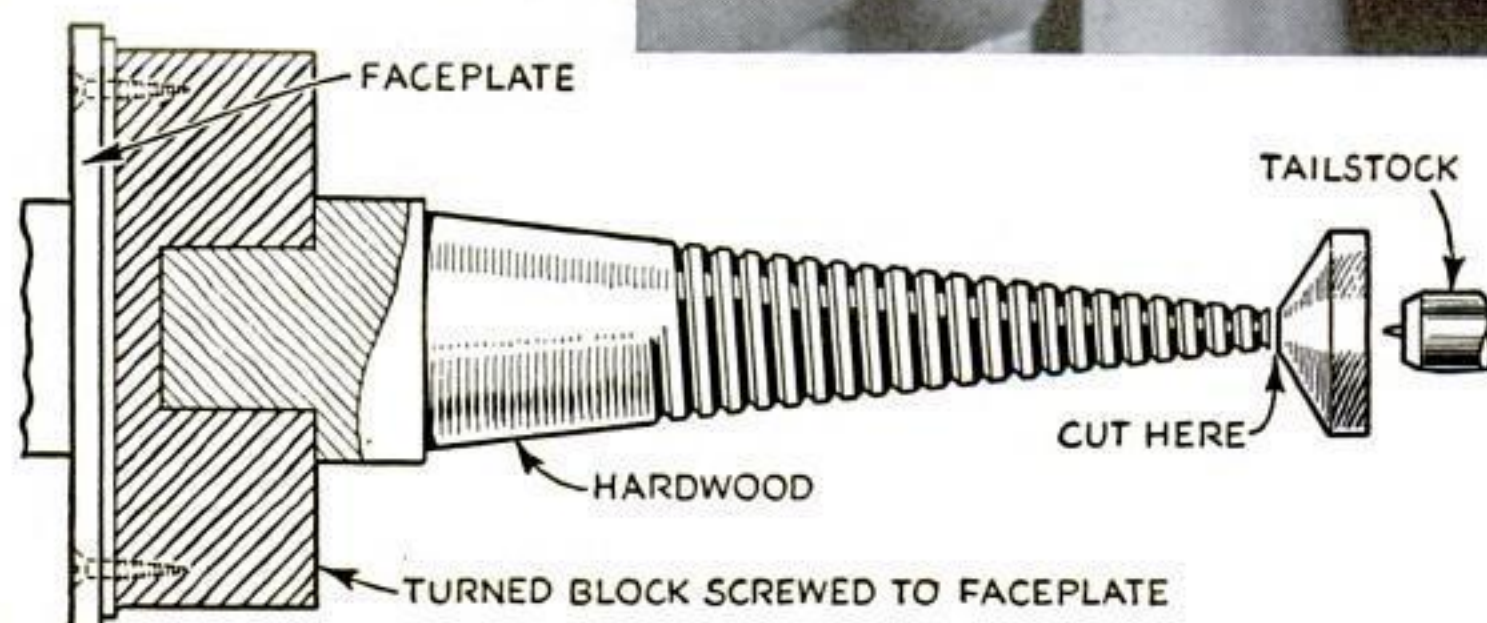
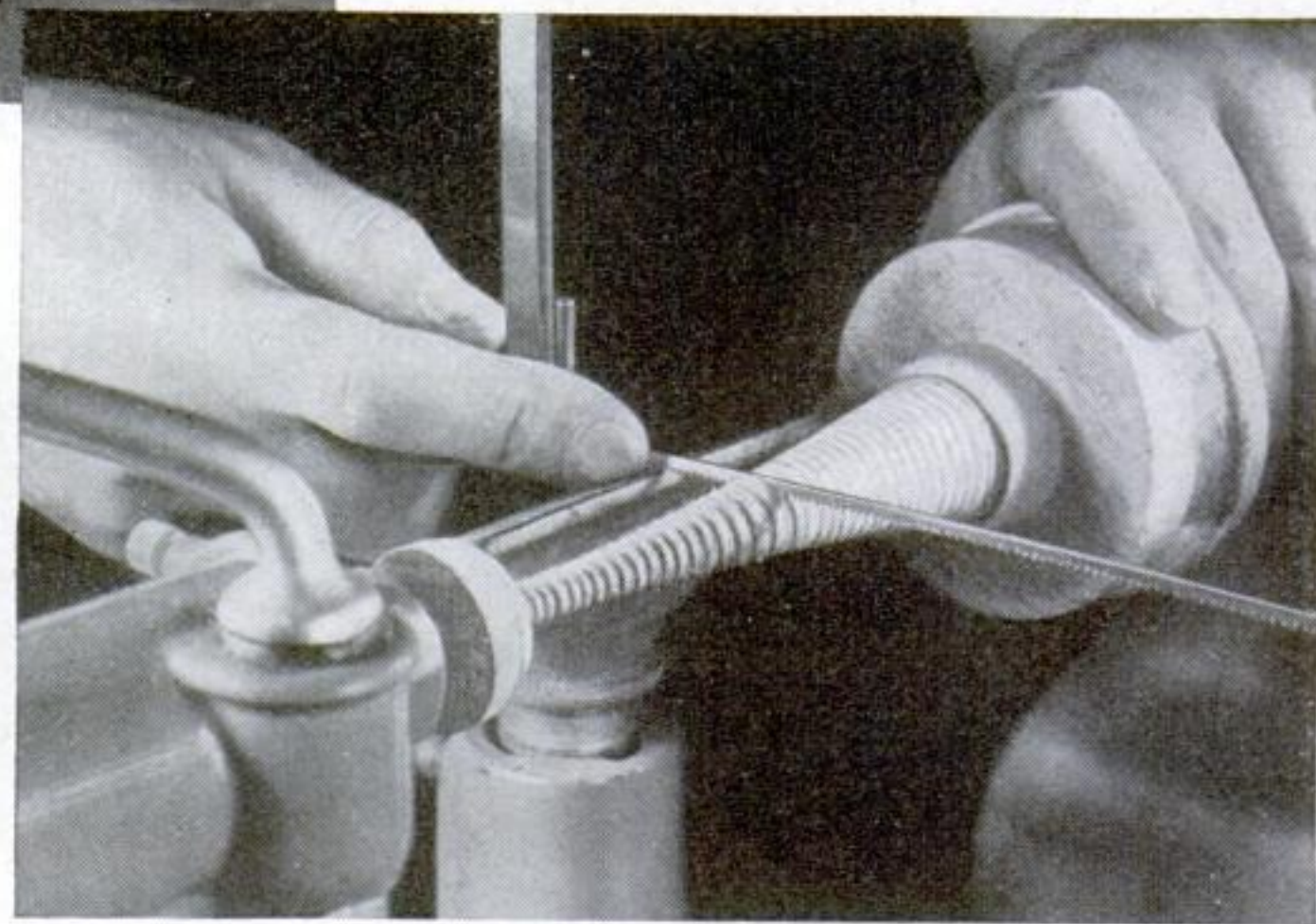
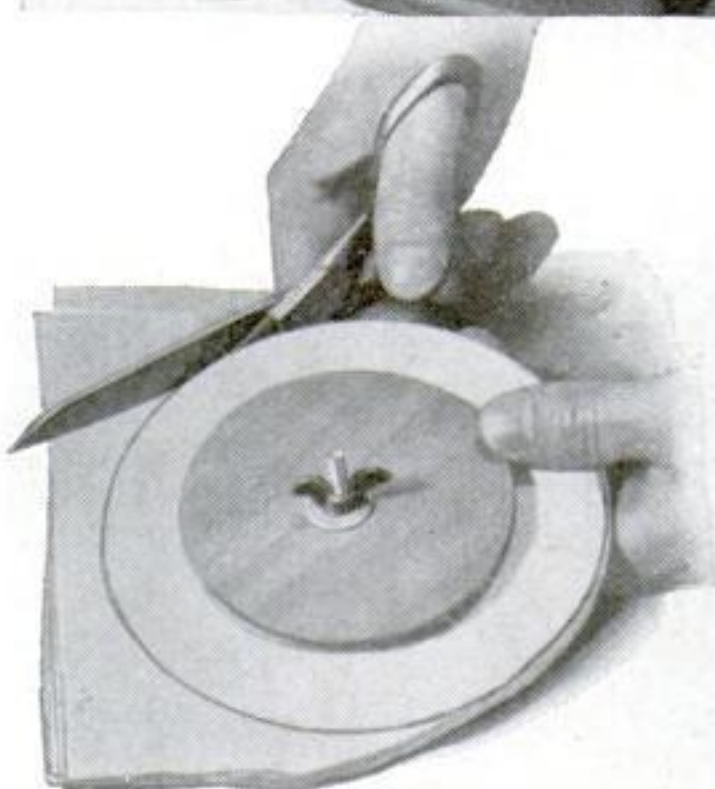
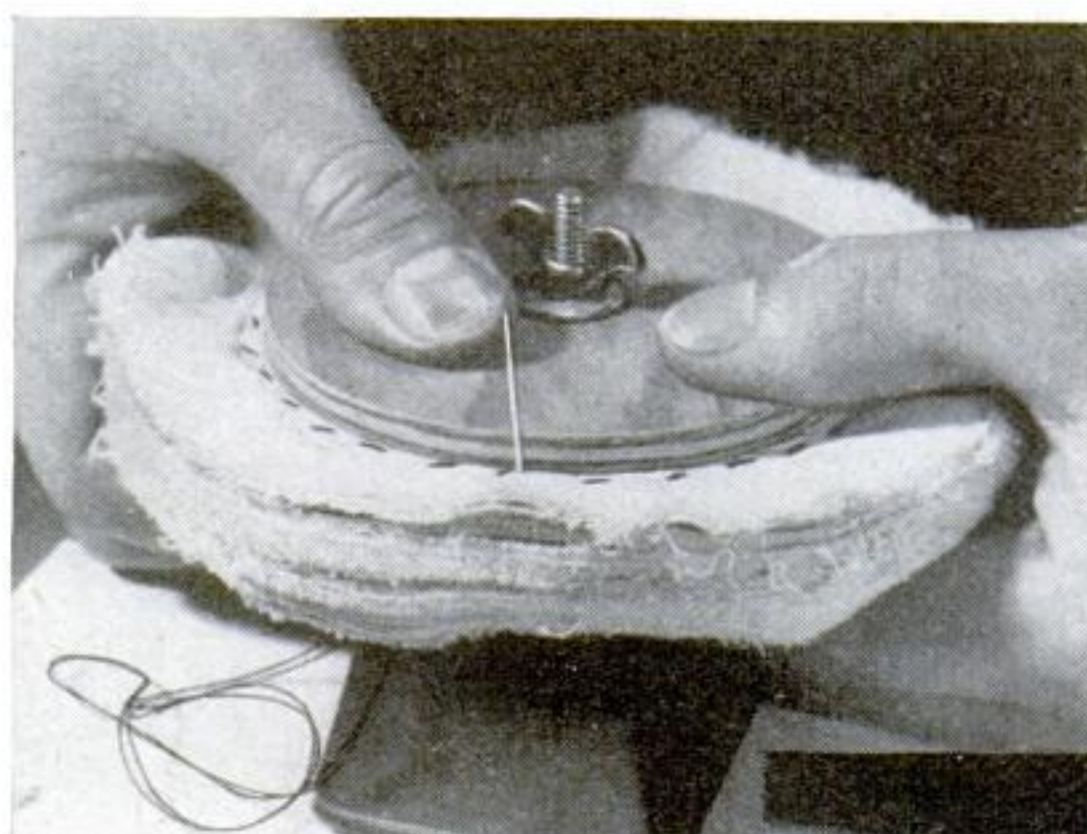
4-in. plywood disk over a small bolt, then put on a 6-in. disk of cardboard, then fifteen thicknesses of muslin, and finally another cardboard and another plywood disk, with a washer and wing nut. When putting on the muslin, apply a 1-in. ring of glue around the hole on every other

piece; it will soak through and form a hard center for the buff. Use the 6-in. cardboard disk as a template for cutting.

To assemble the buff, hold thirty-five or forty thicknesses between the same plywood disks and stitch right through the material with a stout needle and heavy thread. Let the stitches be guided by the edge of the plywood disks. The needle can be pushed through by pressing the end with the eye down against a block of metal as shown. Remove the two wooden disks and stitch around the center hole. You can then enlarge the hole with a $\frac{3}{8}$ -in. metal-cutting drill.

Hold the work for buffing on the underside of the wheel with the top of wheel turning towards you. The buffs should, of course, be touched with any suitable polishing compound beforehand. Two or three buffs are generally used with abrasives of varying degrees of fineness. The first buff is charged with cutting abrasive for the preliminary cutting down to remove the coarser scratches; the last is charged with fine abrasive for the final high polish or "coloring," as it is called.

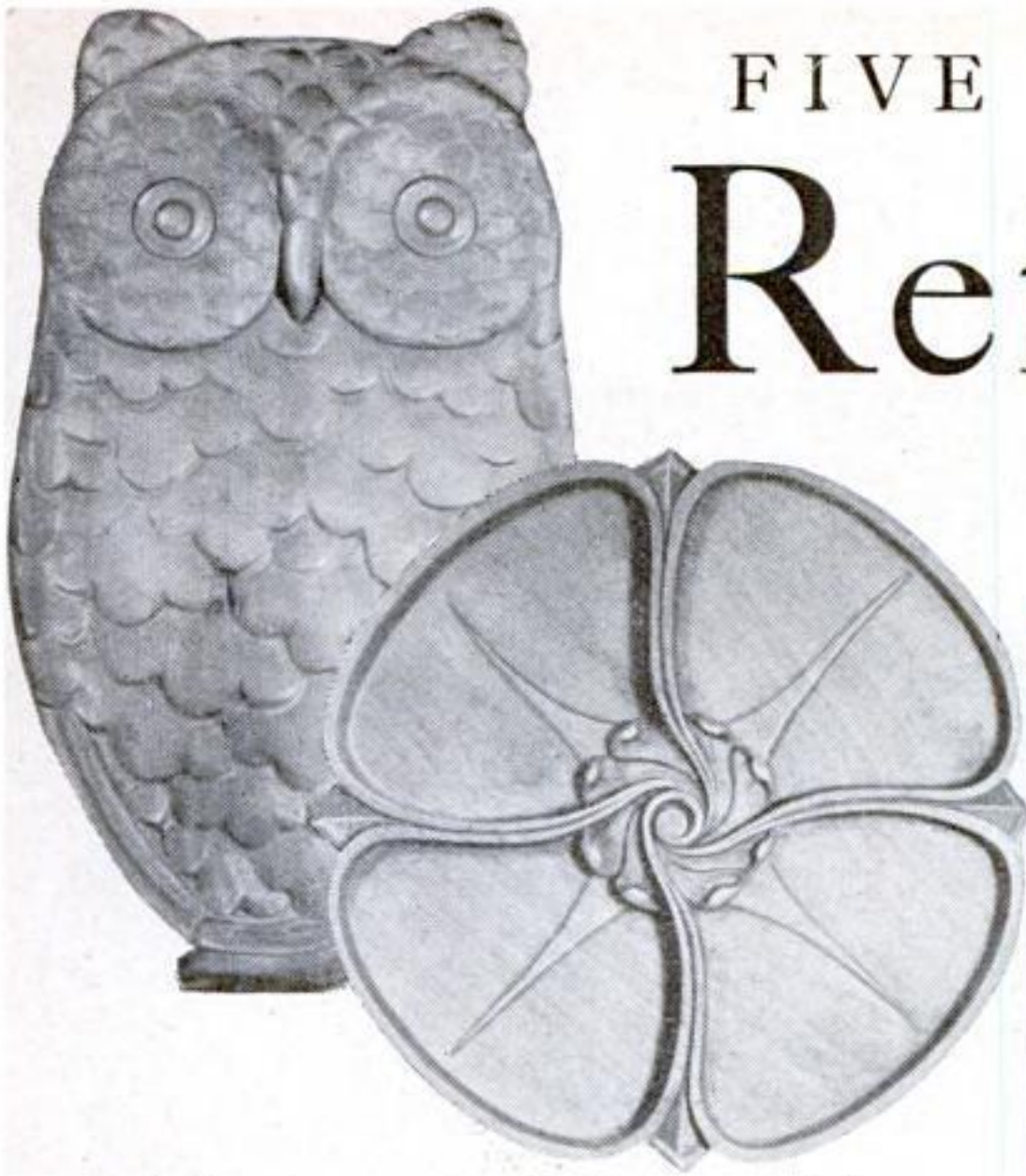
Sticks and blocks of polishing compounds can be purchased at very little cost, or you can make your own, when small quantities are wanted, by pressing the abrasive into cakes with as little melted paraffin as possible. The paraffin acts as a binder. Powdered tripoli is a common and much-used cutting abrasive and can generally be purchased at drug stores. Emery is a still coarser abrasive. Finer polishing is done with various grades of pumice. The highest polish is obtained with rouge, a special grade of iron oxide.



Cutting the grooves in the spindle with a hand scroll saw. The spindle is made in two parts as at the left. The other views show steps in cutting and sewing the disks for the buff

FIVE DESIGNS FOR EASILY CARVED Refreshment Trays

By D. W. PRINCE and SILVIO MARINI



Owl-shaped tray and a Gothic rosette design.
At right: The scallop tray has a good handle

CARVED wooden trays like those illustrated are well within the ability of the average home workshop enthusiast. If a drill press and flexible shaft cutters are available, hand tooling may be almost entirely eliminated; on the other hand, the work can be done without power tools of any kind. The completed trays, which may be used for serving refreshments or as fruit dishes or decorative buffet pieces, are equal in design and finish to expensive imported ones.

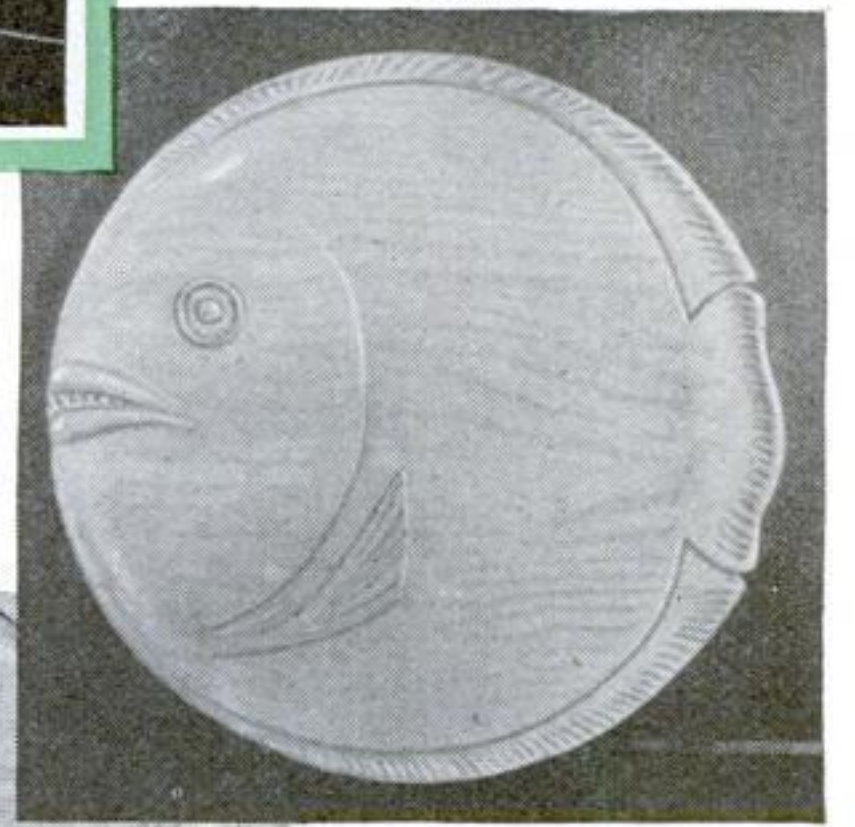
The procedure is to draw on a piece of paper, using 1-in. squares, the design chosen. Transfer to the wood with carbon paper only the lines needed in the roughing out. Saw along the outlines, then rough out the interior. If a drill press is used, have the cutter set to stop $\frac{1}{2}$ in. above the table. By securing the work by means of

waste "ears" and using a gouge, one may do this hollowing equally well although not so rapidly.

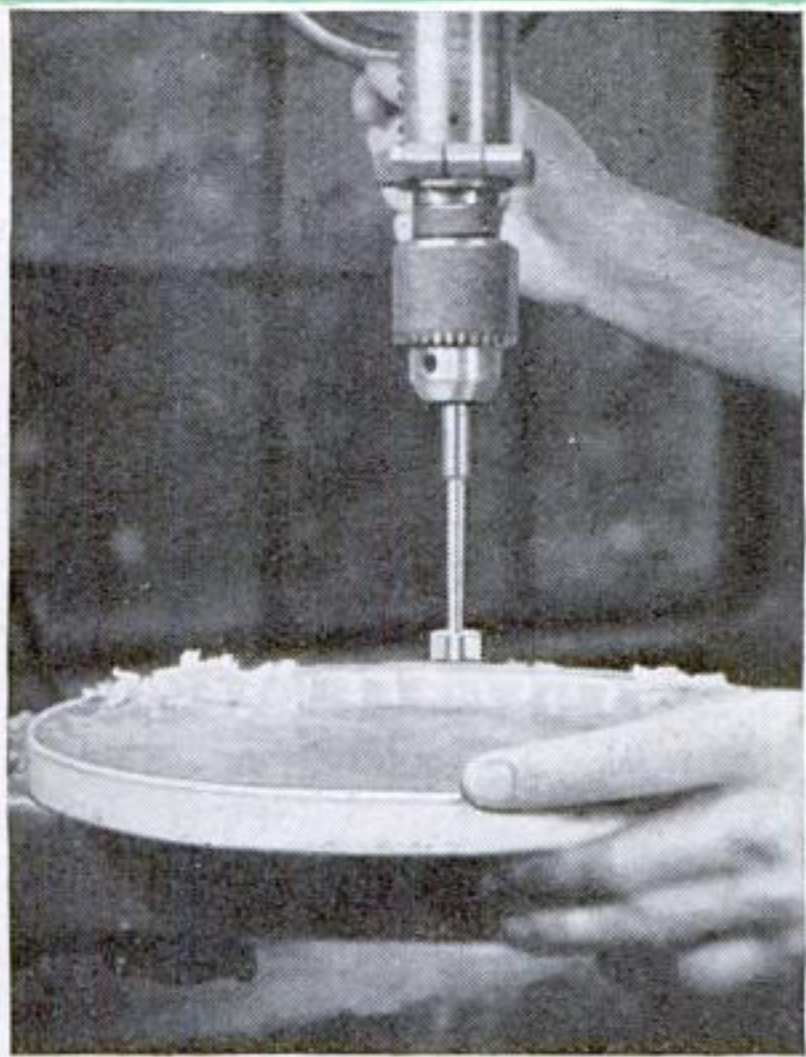
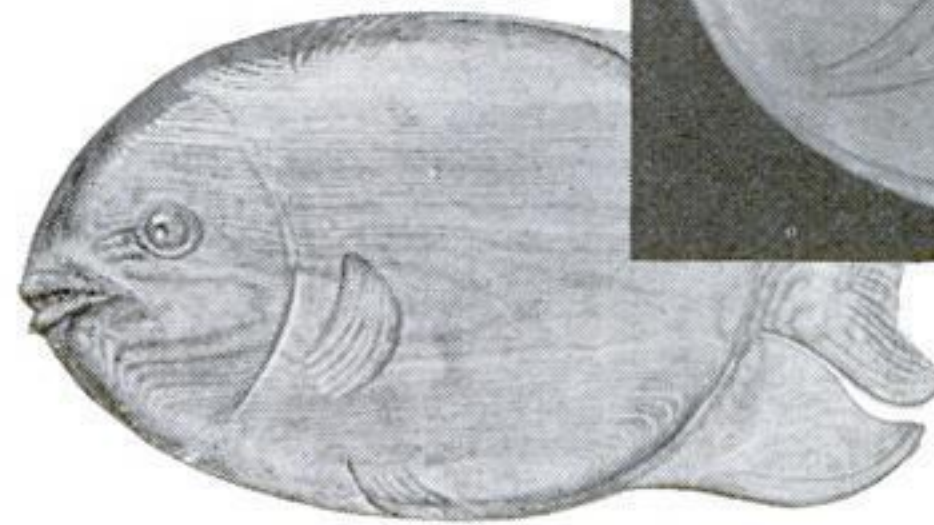
Now the detail lines are transferred and carved in. About $\frac{3}{8}$ in. of wood is left as a minimum thickness. Flexible-shaft carving bits may be used to advantage, or the smaller chisels employed for carving. Sandpapering the sharp edges reduces danger of splintering.

A paraffin wax finish is one of the best, as it does not taint food and is easily renewed. The wax is merely rubbed on cold or slightly warmed. In the Gothic rosette tray, however, the pattern of the rosette may be brought out better by high-lighting with burnt umber, coating with very thin shellac, if desired, then varnishing and waxing.

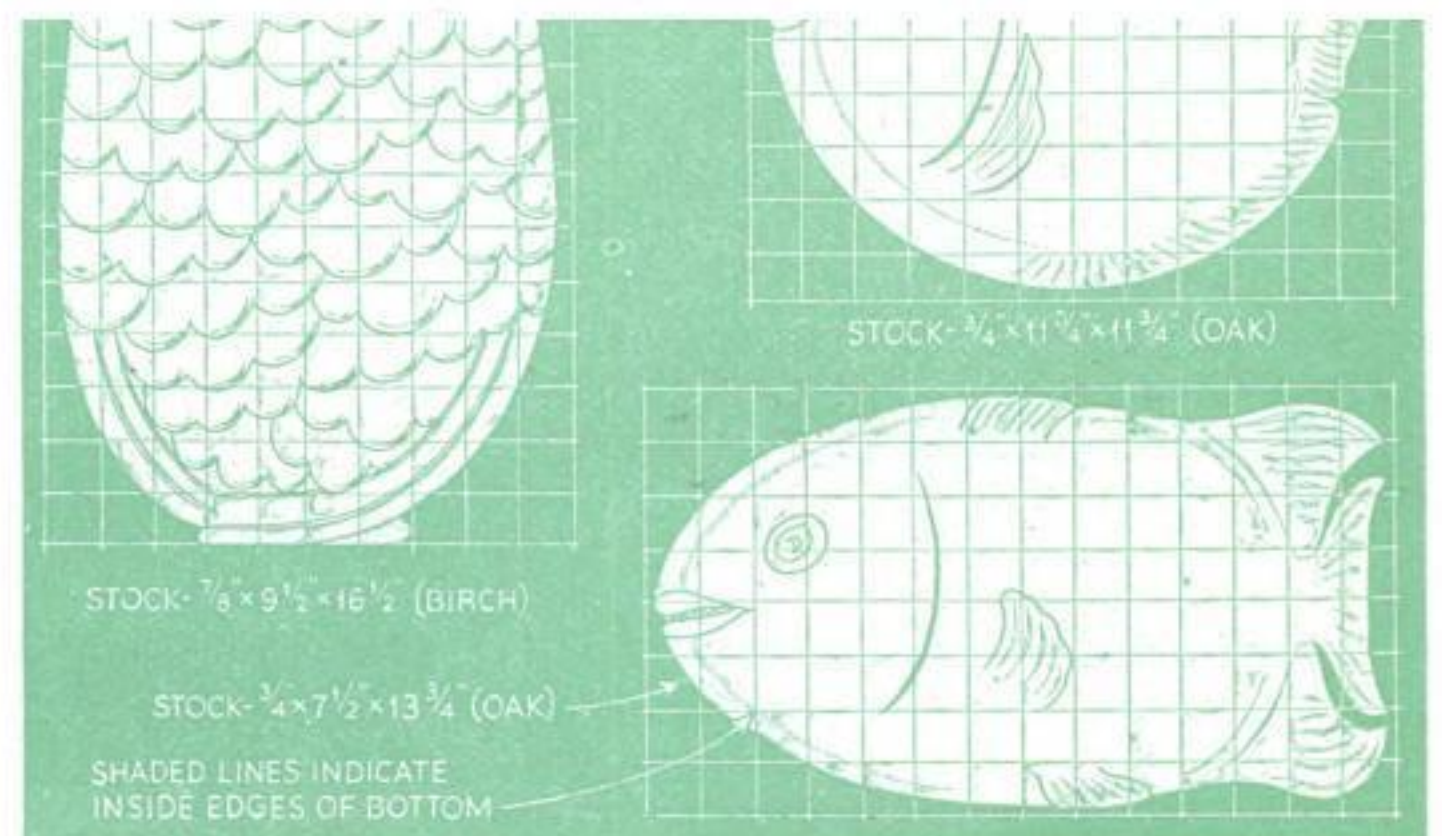
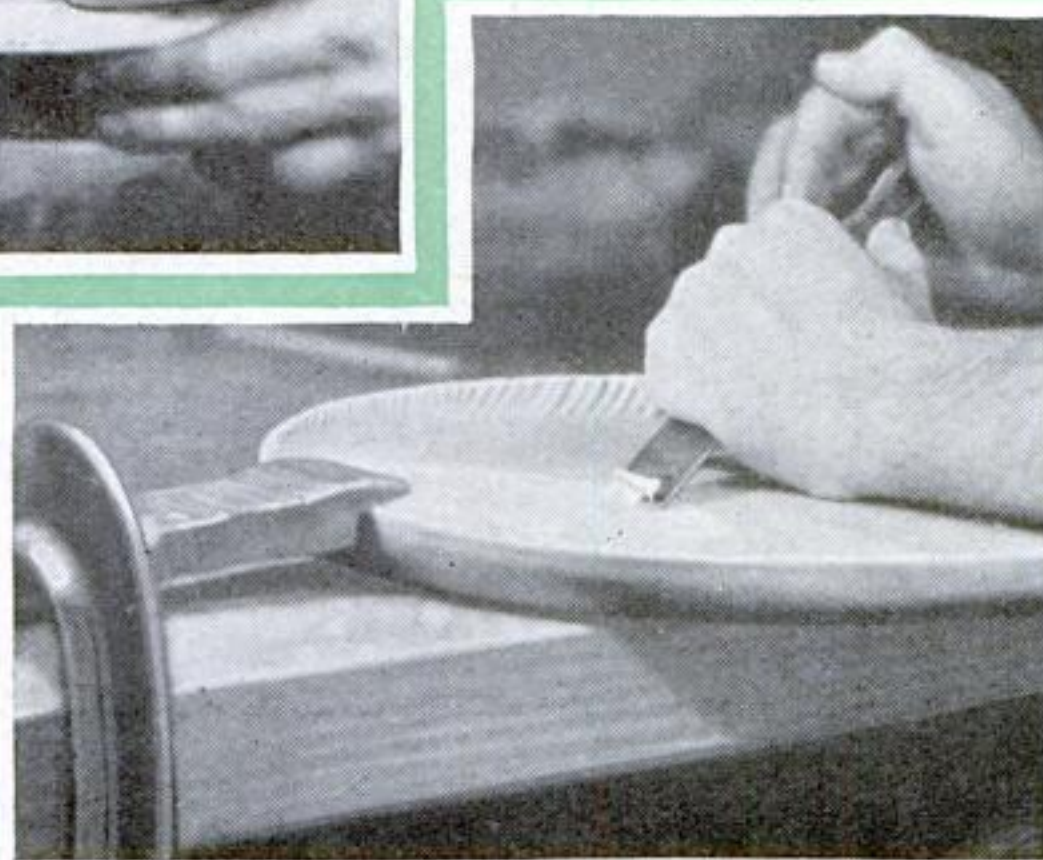
A graduated series of patterns may be drawn to scale, and sets of these trays made to "nest."



For a first attempt, nothing is simpler than a fish design, such as a sunfish or a "pumpkin seed"

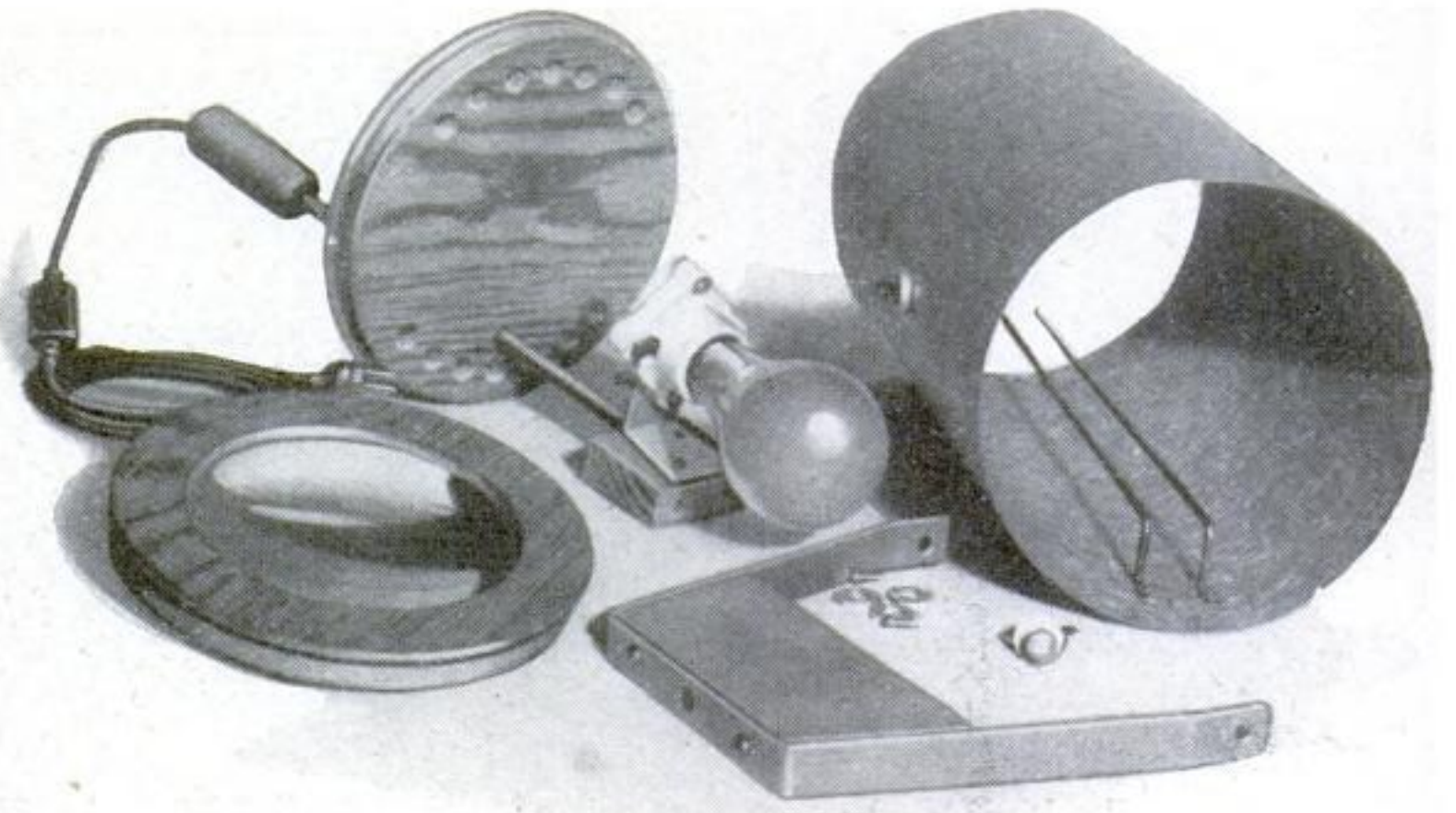
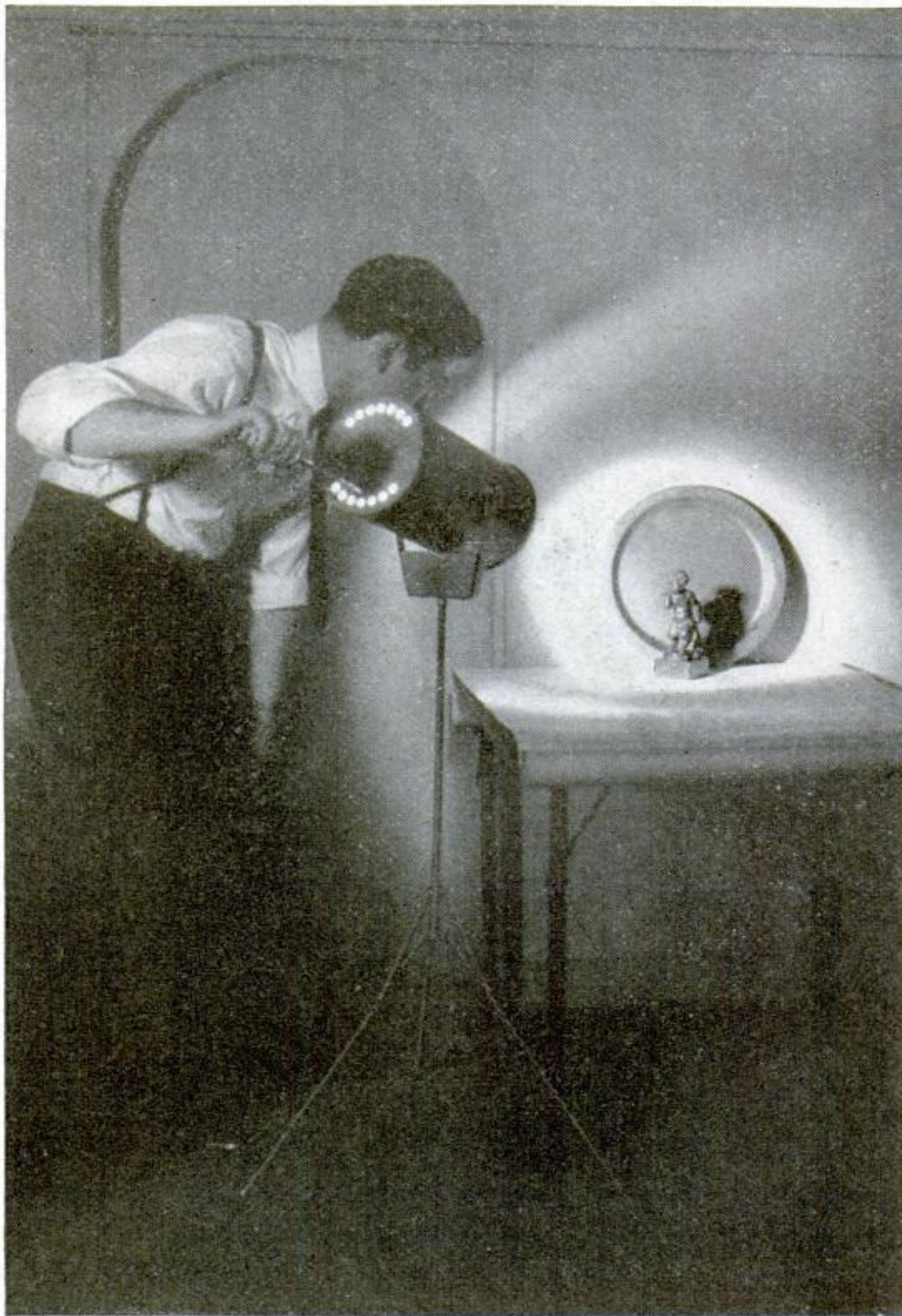


If available, a drill press with a spurless bit or other suitable cutter may be used to rough out the trays. Right: Using a carving chisel. Note the wooden hold-down and iron C-clamp

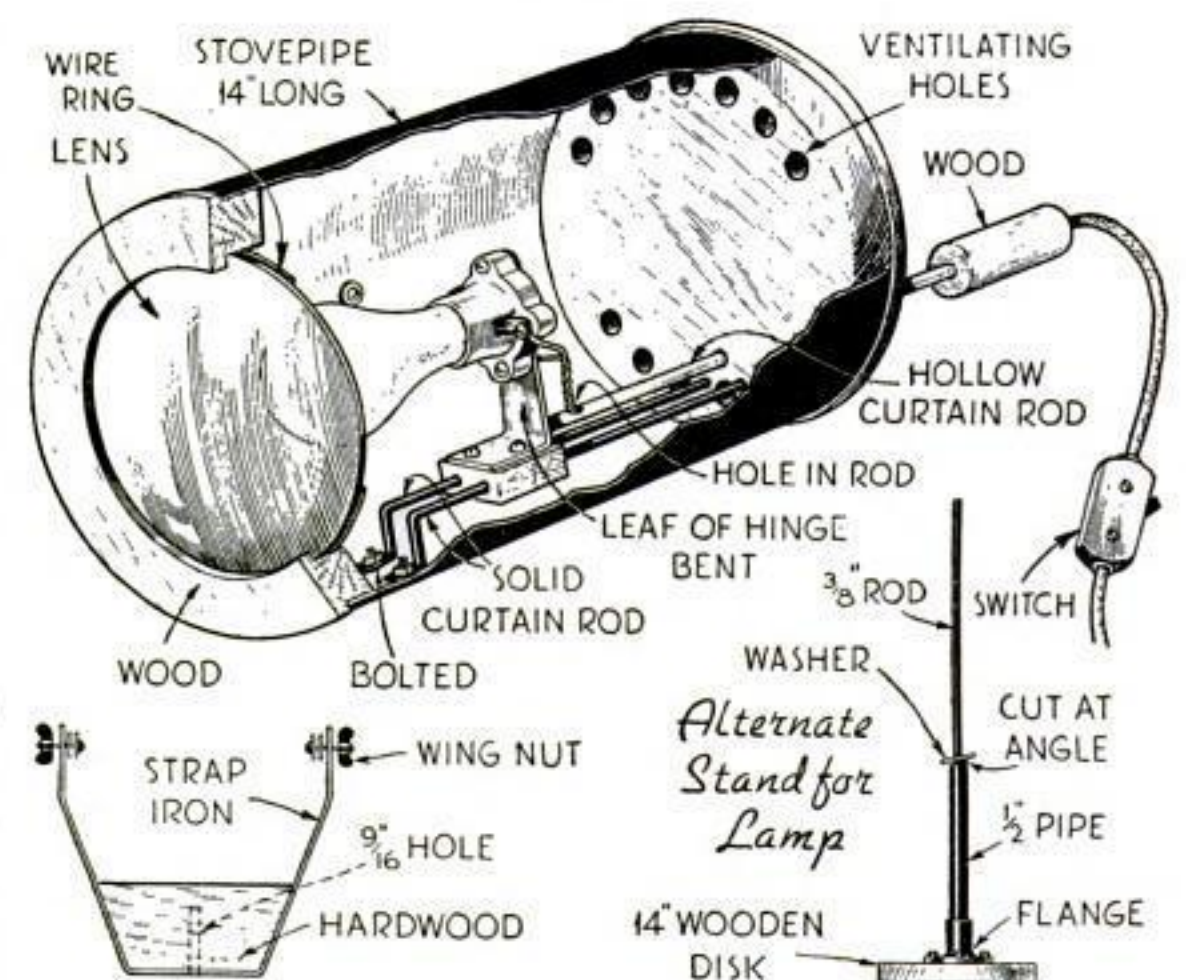


Spotlight

CONSTRUCTED FOR
TWO DOLLARS



The spotlight in use for a still-life study, a photo of the parts before assembly, and, at right, a view broken away to show the focusing arrangement and drawings of the support and one type of stand



MOST amateur photographers feel the need for an inexpensive yet efficient spotlight for portraiture and still-life photography. The light illustrated, which cost only two dollars for materials, has been used for all types of photography and has never failed to produce the desired effect.

The simplicity of construction is apparent from the photographs and drawings. Some dimensions have been omitted because they depend on the size of the

condensing lens used. The writer happened to have a 6-in. lens and built the spotlight around it. However, if the reader intends to buy a lens, he will find one of about 3-in. diameter to be less expensive, easier to handle, and perhaps even more efficient.

Fundamentally, the spotlight consists of a wooden ring to hold the lens, a housing made of stovepipe, two round curtain rods on which the lamp base slides, and a wooden disk, which is drilled to afford

ventilation. The bulb is an ordinary photoflood lamp. The inside of the stovepipe should be painted aluminum.

An old music stand is used as a base for the "spot," or a stand may be made from pipe.—MICHELE DE SANTIS.

LOW-COST PHOTO LAMP STAND MADE FROM CURTAIN RODS

CONSTRUCTED from flat curtain rods, this stand for photographic lamps is handy, compact, and light in weight. In one respect it is superior to the purchased article because the lamp can be used in almost any desired position—from the floor up to a height of over 6 ft.

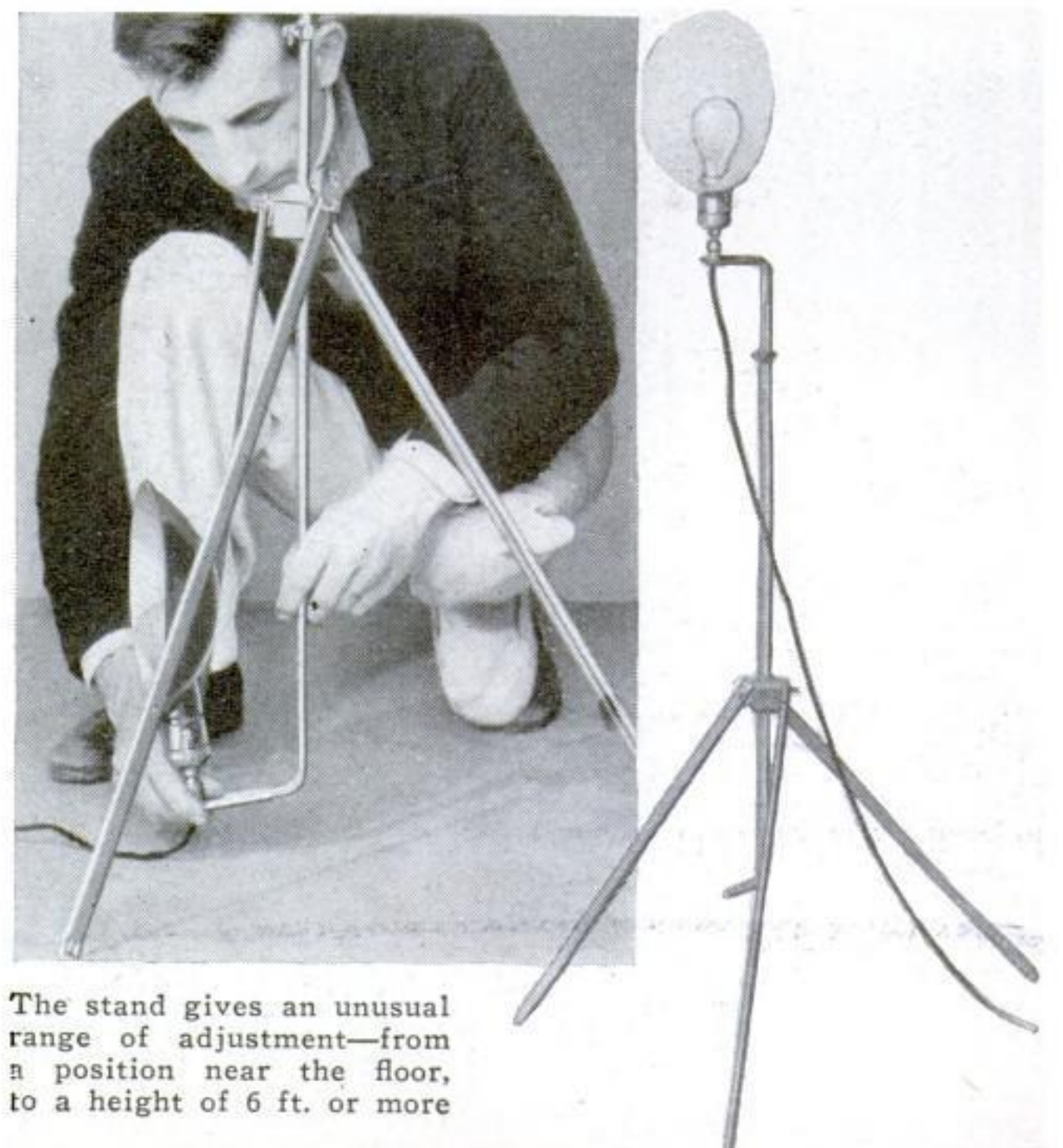
Rods 26 in. long were chosen for the stand illustrated. A complete rod serves for the standard, and half rods for the legs. The writer made two stands, using the other half rods for the second stand.

In preparing the legs, snip off the bent ends, grind or file them smooth, and drill for the pivot screws. The cap of the tripod head, to which the legs are clamped, is made from a triangle of stiff sheet metal. Aluminum 1/16 in. thick is ideal. For the opening to receive the standard, make an H-shaped cut with a chisel or jig saw, bend the flaps upward, and file them smooth. Drill the nail and pivot holes, and bend the corners of the triangle down,

forming a cap to fit the hexagonal hardwood block, which is made as detailed in the drawings.

The block is laid out on a circle of 31/32-in. radius. It greatly stiffens the cap without adding much to the weight. Mark the position of the standard hole, using the cap as a template. Notch the leg sides to clear the heads of the clampscrews, and if square-headed screws are obtainable, fit the notches to the heads to prevent their turning. Also, bore the hole for the wood screw used to clamp the standard.

Assemble the head with
(Continued on page 104)

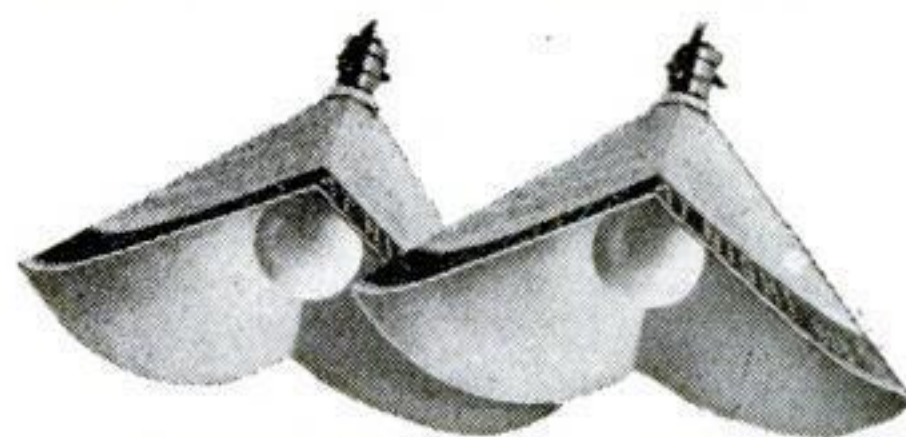


The stand gives an unusual range of adjustment—from a position near the floor, to a height of 6 ft. or more

1 Kodak "SS" Film
in your camera



2 Two or three
Photoflood Lamps
and reflectors



Everything you need to make snapshots at NIGHT



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You can start right in snapshooting tonight. For now, even a simple Brownie makes snapshots (instantaneous pictures) indoors after dark.

Just use Kodak "SS" Film, and two or three of the new No. 2 Mazda Photoflood lamps, which last for hours, and Model B Kodak Handy Reflectors.

If your camera has an *f.6.3* or faster lens, No. 1 Photoflood lamps are powerful enough.

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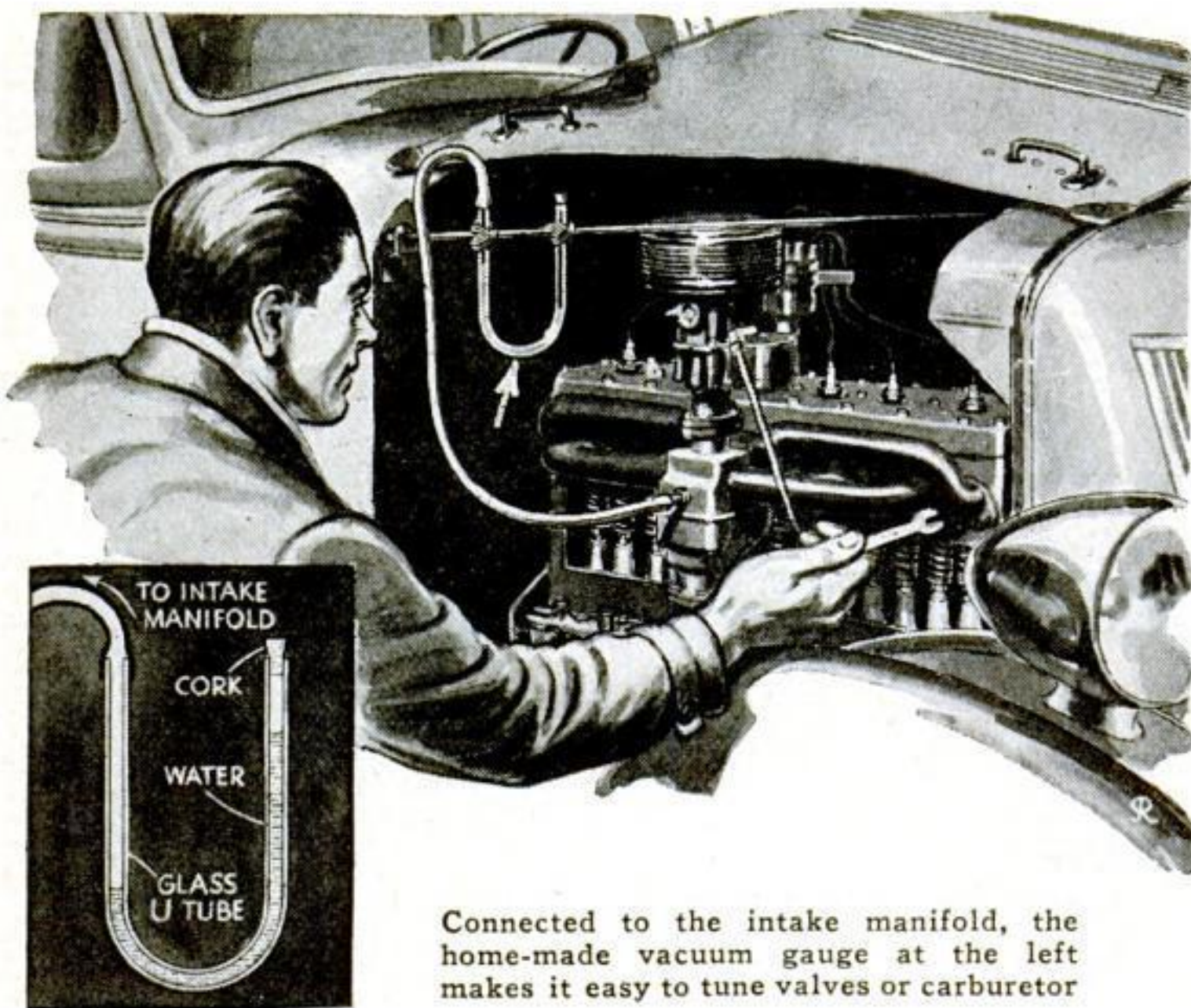
Written in simple, non-technical language. Illustrated with helpful pictures and diagrams. Contains everything you need to know about *both kinds* of night pictures—snapshots with Photoflood lamps, *fast exposures* with Photoflash lamps. (You can use Photoflash lamps, each good for one picture, if your camera can be set for "time.") The booklet tells you how to arrange your lights ... how to place your subject ... suggests a variety of picture opportunities. Get a copy at your dealer's today ... Eastman Kodak Co., Rochester, N. Y.



Six Kinks for Car Owners

One of These Timely Suggestions, Contributed by Other Readers, May Help You To Solve a Vexing Problem in Driving or Caring for Your Auto

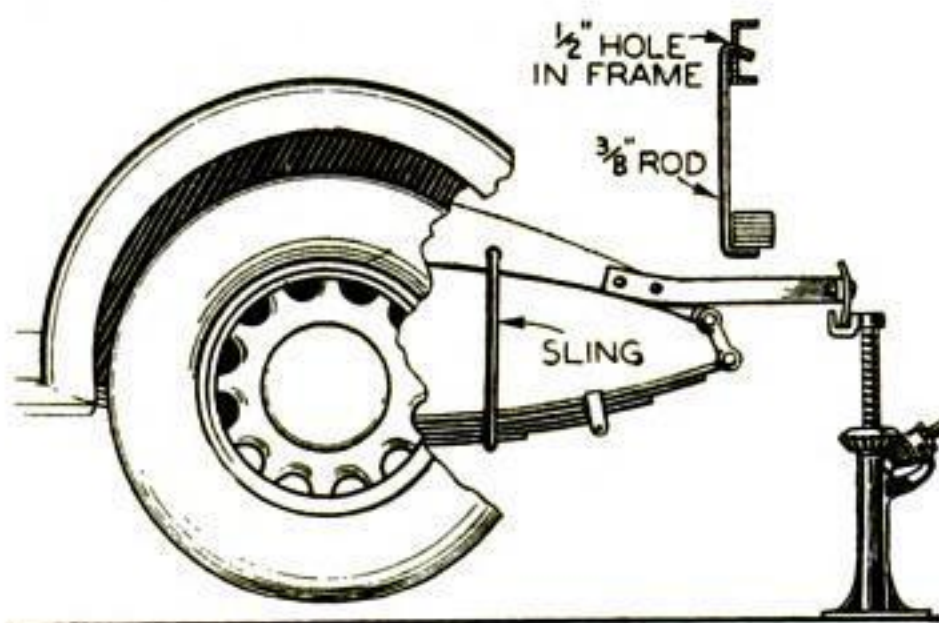
TO SIMPLIFY the job of adjusting the idling speed and setting the valves on my car, I devised the professional-type vacuum gauge shown at the left. It consists simply of a $\frac{1}{4}$ -inch-bore U tube with one leg sealed with a cork or sealing wax and filled with enough water to bring the level up to within about one inch of the sealed end. In use, the open end is connected to the car's intake manifold through a length of rubber tubing. When the motor is started, the vacuum created in the manifold will pull the water down in the sealed leg. The carburetor idling adjustment then should be regulated for maximum deflection, and the valves adjusted for *uniform* deflection in each set (intake and exhaust) when feeler gauges are inserted.—E. A. W.



Connected to the intake manifold, the home-made vacuum gauge at the left makes it easy to tune valves or carburetor

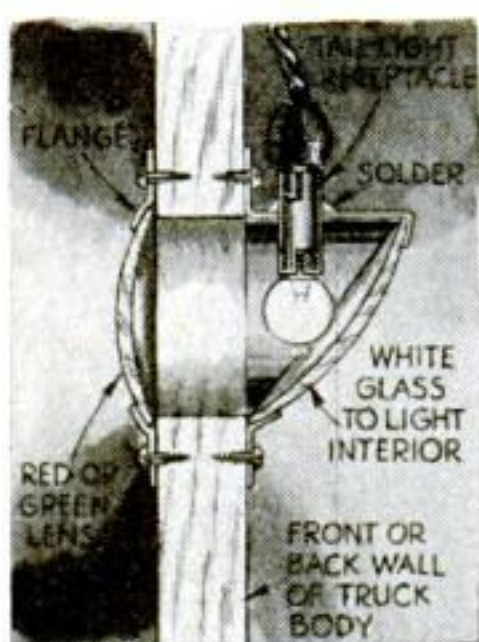
Metal Sling for Springs Aids In Jacking Car

WHEN using a bumper-type jack, it is often necessary to raise the car body a considerable distance before the wheel is lifted free of the ground. An easily made spring sling, as shown below, solves problem easily. The hook-shaped piece of $\frac{3}{8}$ -inch steel rod is placed under the spring and hooked into a hole in the car frame. The sling should be long enough to go into place easily.—H. J.



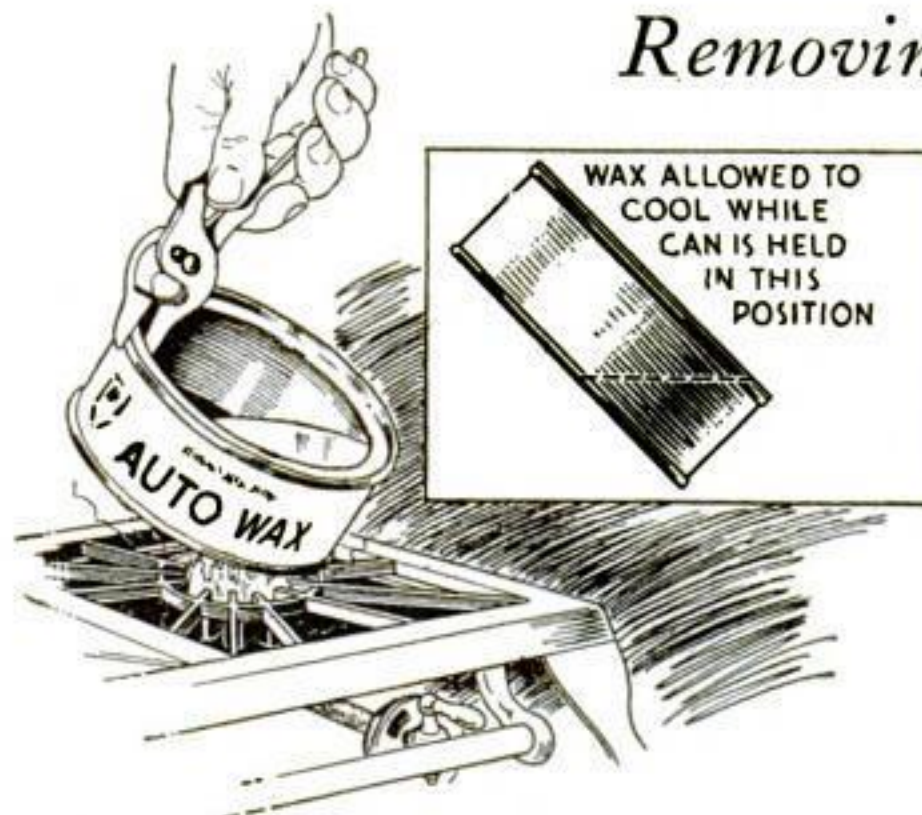
The spring sling, and how it is put in place

Double-Purpose Light for Auto Trailers



the rear wall of the trailer body. A square of frosted glass mounted at an angle in the lamp housing allows the light to be reflected inside the body.—R. L.

Owners of small trailers and trucks can provide a handy interior light by making their safety tail lights do double duty. As illustrated, the combination light consists of a single bulb mounted behind a red-glass window fitted into a hole cut in



Removing Wax Polish from Cans

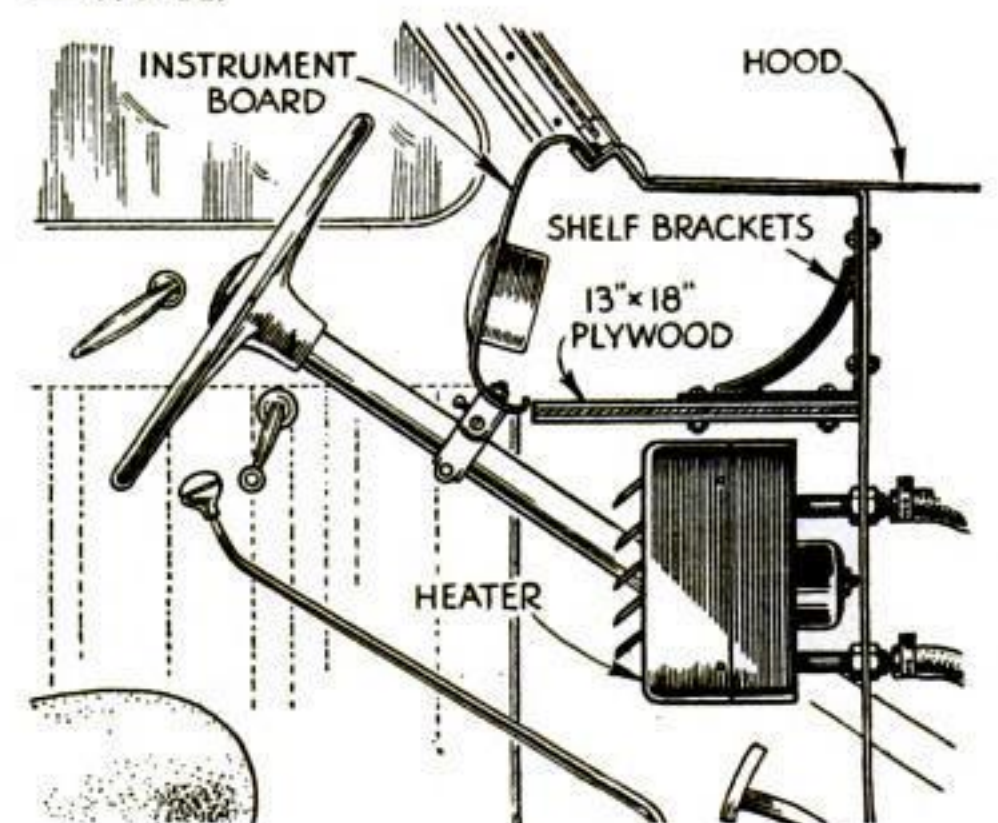
BY HEATING the can gently, you can reclaim that last hard-to-get-at ring of polish that always forms in an almost-empty container of automobile wax. Hold the can over a gas flame, being careful to keep the temperature below the point where the wax smokes. When all the wax has melted, tip the can and hold it in that position until the polish cools and hardens. Having collected along one side of the can, the wax is in a position to be scooped out easily with the polishing rag.—W. A.

Wooden Coat Hangers form Battery Lifter

A FEW weeks ago, it became necessary for me to lift the battery out of my car. Not having a regular battery lifter handy, I rummaged through my tool box for something that would serve the purpose. After several unsuccessful tries with pliers, screw drivers, and wrenches, I hit on the idea shown at the right. Borrowing two coat hangers from our hall closet, I slipped the wire hooks under the short metal connection strips between the battery cells and used the curved wooden portions as handles. The battery came out so easily that since then I have reconstructed two coat hangers by cutting several inches from the ends of the wooden strips to form short handles, which I then taped. They now form a valuable addition to my repair kit. An even more convenient lifter could be made from two coat-hanger hooks attached to a single wooden handle.—H. B.

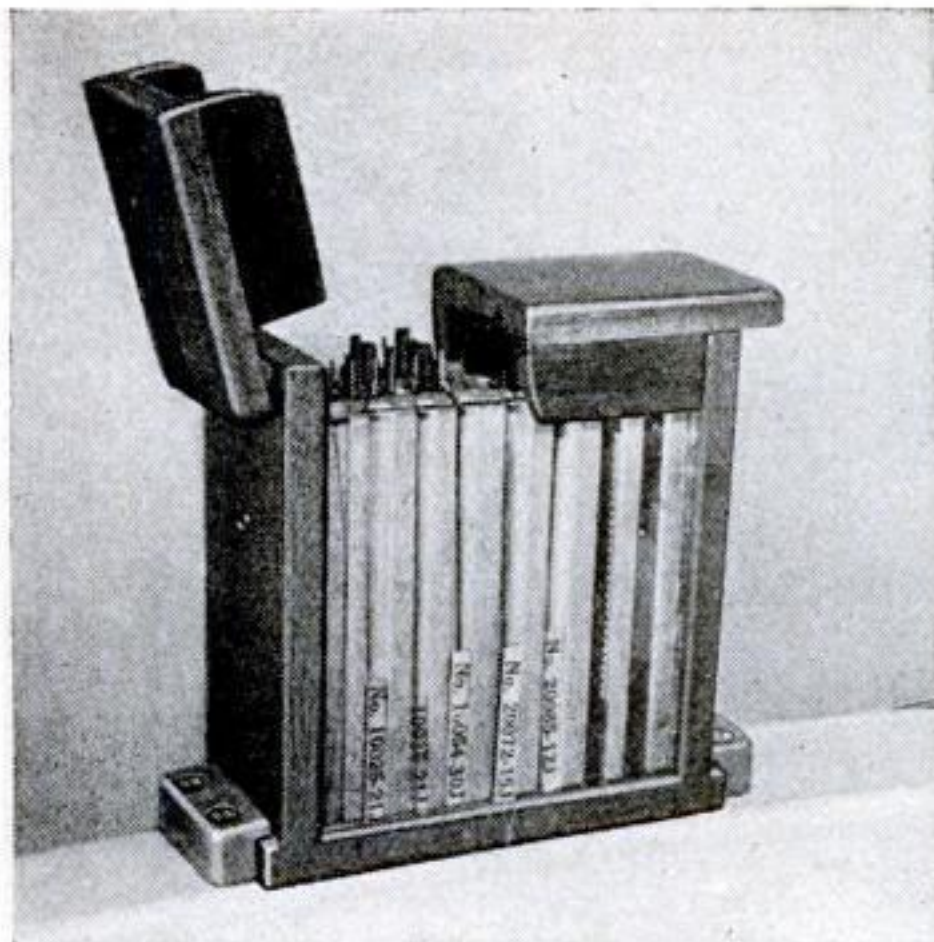


Hooked under the cell straps, coat hangers form a battery lifter



Deflector Under Dash Improves Car Heater

BECAUSE of its position under the dashboard, an automobile hot-water heater often wastes a large portion of its heat. Rising from the heating core, the warm air becomes trapped under the dash. To overcome this, a panel of plywood or metal should be installed directly over the heater, as indicated above. Serving as a deflector, the panel will prevent the warm air from becoming trapped behind the instruments and will direct it out into the car where it is needed. A pair of large shelf brackets or angle irons can be used to fasten the panel to the cowl wall as suggested in the drawing.—E. A. W.

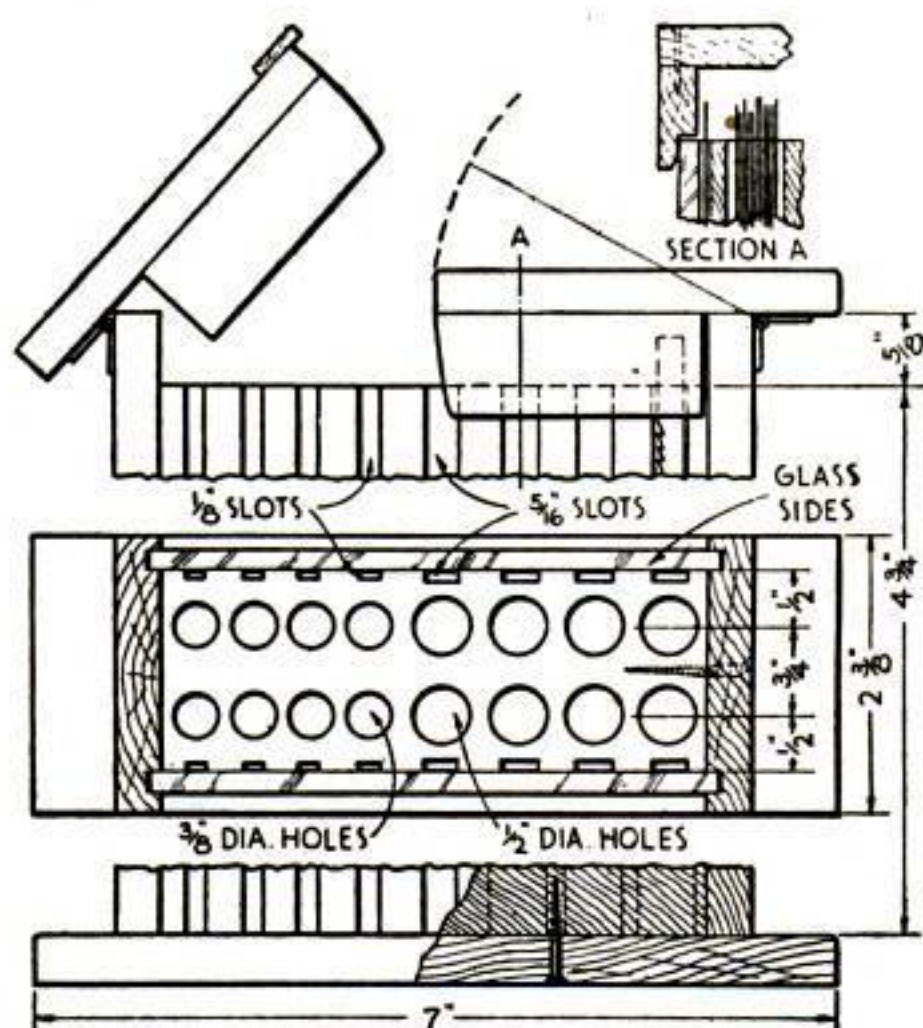


BOX WITH VISIBLE INDEX HOLDS JIG-SAW BLADES

EASE in selecting the proper blade and convenience in knowing how many blades you have in reserve will repay the trouble of making this glass-sided box for your scroll saw. One blade of each size is kept in the slots against the glass, and a reserve supply in the hole directly back of it. The blade number, cut from the original package, is slipped in the slot so it is visible through the glass. This information is useful when reordering or when following specific directions that give the blade size to use.

The box is constructed around a block $1\frac{3}{4}$ by $4\frac{3}{4}$ by $4\frac{3}{4}$ in., laid out as shown below. Drill the holes lengthwise of the grain, and cut the slots on the outside faces. The sides and the bottom, which are slotted for the glass, are screwed to the block. The half lids are hinged on the outside and allowed to project at the ends so they may be flipped open when a blade is wanted.

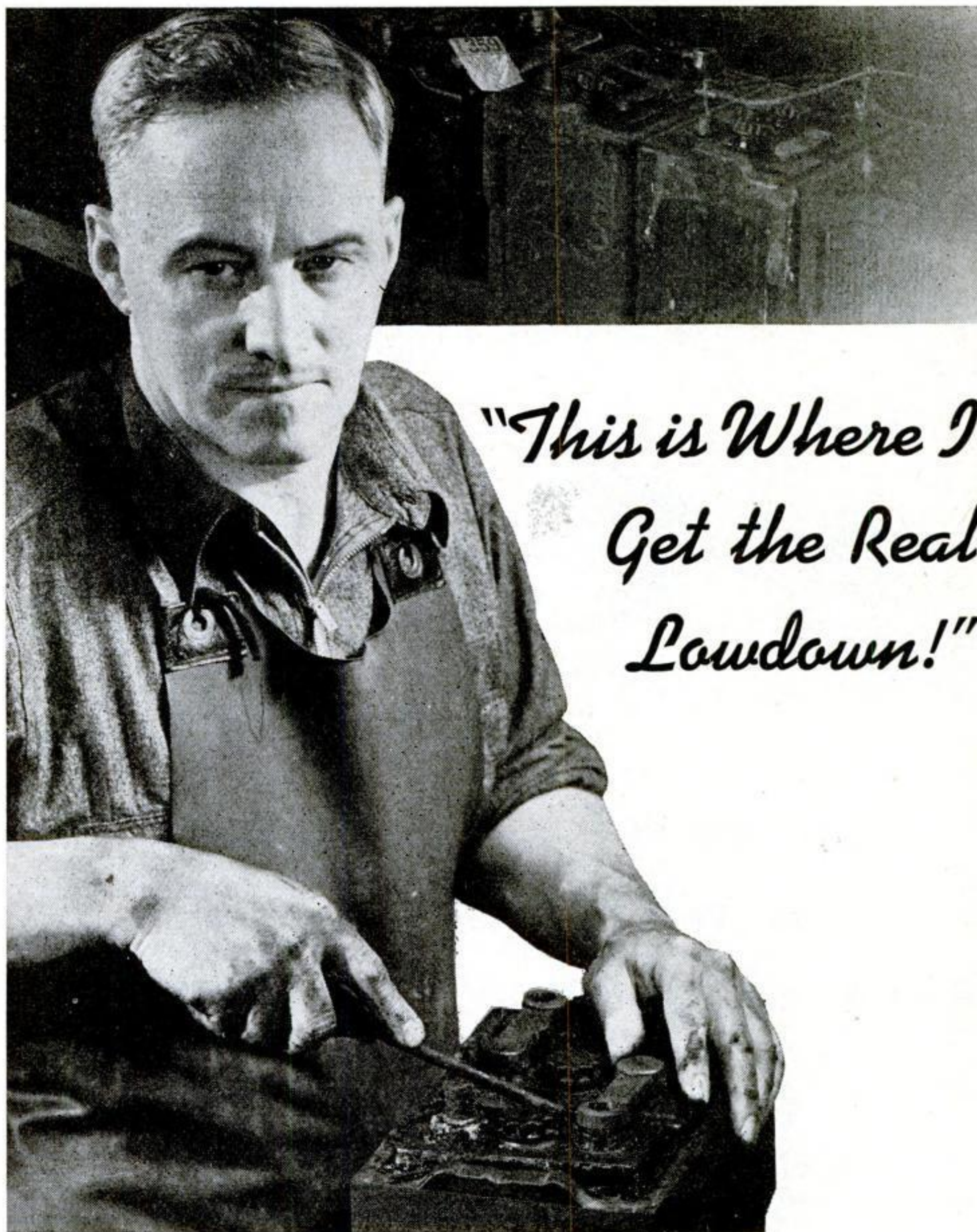
A convenient place for the box is on the overarm of the saw, to which it may be secured by machine screws. Put a rubber strip under each end to take up irregularities of the casting.—JOHN P. ADAMS.



Side view of the case with the central part broken away to make room for the plan view

SHARPENING A GLASS CUTTER

WHEN the ordinary wheel-type glass cutter becomes dull, it can be sharpened on an emery wheel. Just press it against the side of the grinding wheel very lightly with the handle at a 45-deg. angle to the plane of the wheel. Grind both sides of the little cutter wheel in this manner, and then rub the ground edges up and down the side of an oilstone a few times.—MILTON MONSON.



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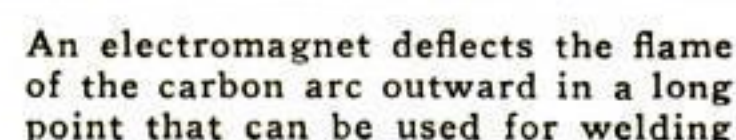
Ask your dealer for this saw by name: "Disston DeLuxe", etched on the blade. See the high, smooth finish . . . accurate fitting . . . keen teeth, that hold their cutting edge. Ownership of a Disston DeLuxe Saw is of itself inspiration to build pieces of which you can be proud.

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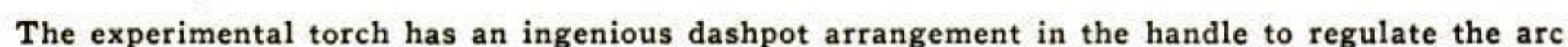
An electromagnet deflects the flame of the carbon arc outward in a long point that can be used for welding

Electric-Arc Torch

WELDS SMALL WORK

The electric arc which is formed between two carbon rods in contact arises from the vaporization of the rods when sufficient current flows through their tips. The hot conducting gases produced at the point of contact maintain the arc at the expense of the carbon rods, which slowly wear away. That these hot gases or flames consist of electric charges in motion is shown by the fact that they are deflected by a magnetic field.

In order to compensate for the wearing of the carbons, a device is provided to bring them together slowly. This is made very simply and consists of a dashpot, the shell of which is the handle of the torch. So that the motion will be quite slow, the piston moves through a heavy oil. A hole is drilled through the piston in the direction of its travel to accommodate a tube of approximately 1/32-in. bore and 1/64-in. wall. This should be a force fit. The tube is allowed to extend a bit beyond the face of the piston, so that it may be squeezed together if necessary to make an adjustment. A strong, phosphor-bronze helical spring, pushing against the piston, drives it through the oil, which flows through the tube. Both the size of the hole through which the oil flows and the grade of the oil may be used to regulate the piston's speed of travel. To allow for a rapid resetting of the piston, a flap valve of .005-in. spring steel is mounted on the end of the piston over a 1/8-in. diameter hole. It is important to solder



Address-----

this valve to the piston as far from the hole as possible to prevent permanent bending by the sudden rush of oil as the piston is reset.

A slider, fastened to the outer end of the connecting rod, has a small pin attached to its underside. This communicates the motion of the piston to the two carbon-support arms. On the top of the slider is a small handle for resetting the piston.

The carbons are held by split clamps and insulated by a heat-resisting material, such as asbestos. The carbon-support arms are about 4 in. long and shaped as shown in the sketch. The curve along which the pin slides approximates a circle with a radius of 7 in. A smooth curve is necessary to make the carbons move together evenly. A small helical spring is attached to the far ends of the two carbon supports to bring the two carbons together.

The arc and the electromagnet are connected in such a way that the flame is blown outward. The leads to the two carbons should be made of flexible copper braid in order not to interfere with their motion.

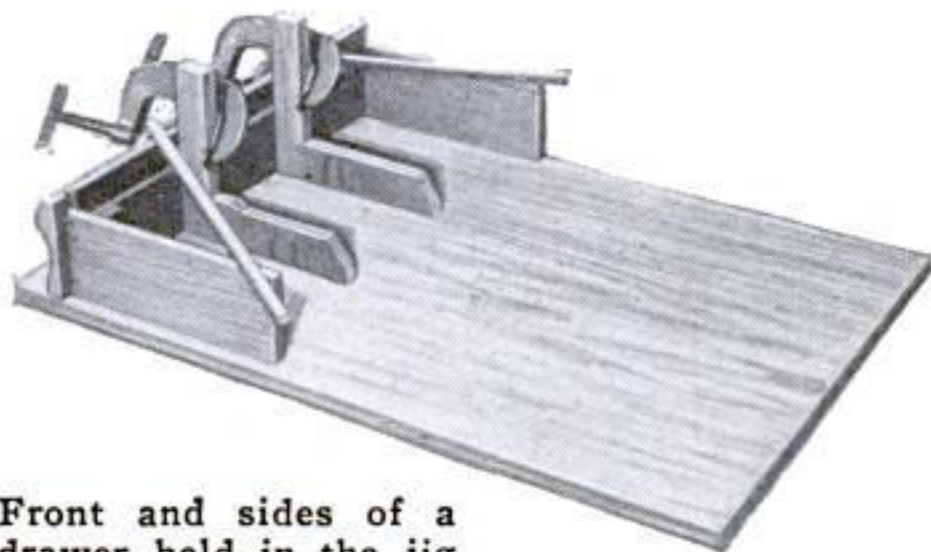
The arc shown in the photograph required 8 amperes direct current. However, when this is used, the carbon connected to the positive terminal should be larger than the negative carbon because it wears away nearly twice as fast. With alternating current, both carbons can be the same size.

The dimensions given are suggestive of a model made by the author, but the size of the torch may be modified to suit individual desires.

JIG HELPS TO ASSEMBLE DRAWERS ACCURATELY

GROOVING the sides and fronts of cabinet drawers is a simple job on the circular saw, but the task of assembling the parts without twist or wind, so that the finished drawer will fit the runways properly, requires so much time and effort that many amateur craftsmen avoid the making of drawers altogether. With the jig illustrated, a drawer can be assembled in five minutes without any special care.

A baseboard of $\frac{3}{4}$ -in. plywood approximately 20 by 30 in. has two L-shaped up-



Front and sides of a drawer held in the jig

rights secured to it with glue and screws. The faces of the uprights must be perpendicular to the surface of the baseboard. The uprights may be about 5 in. apart and spaced 3 in. from the front of the baseboard.

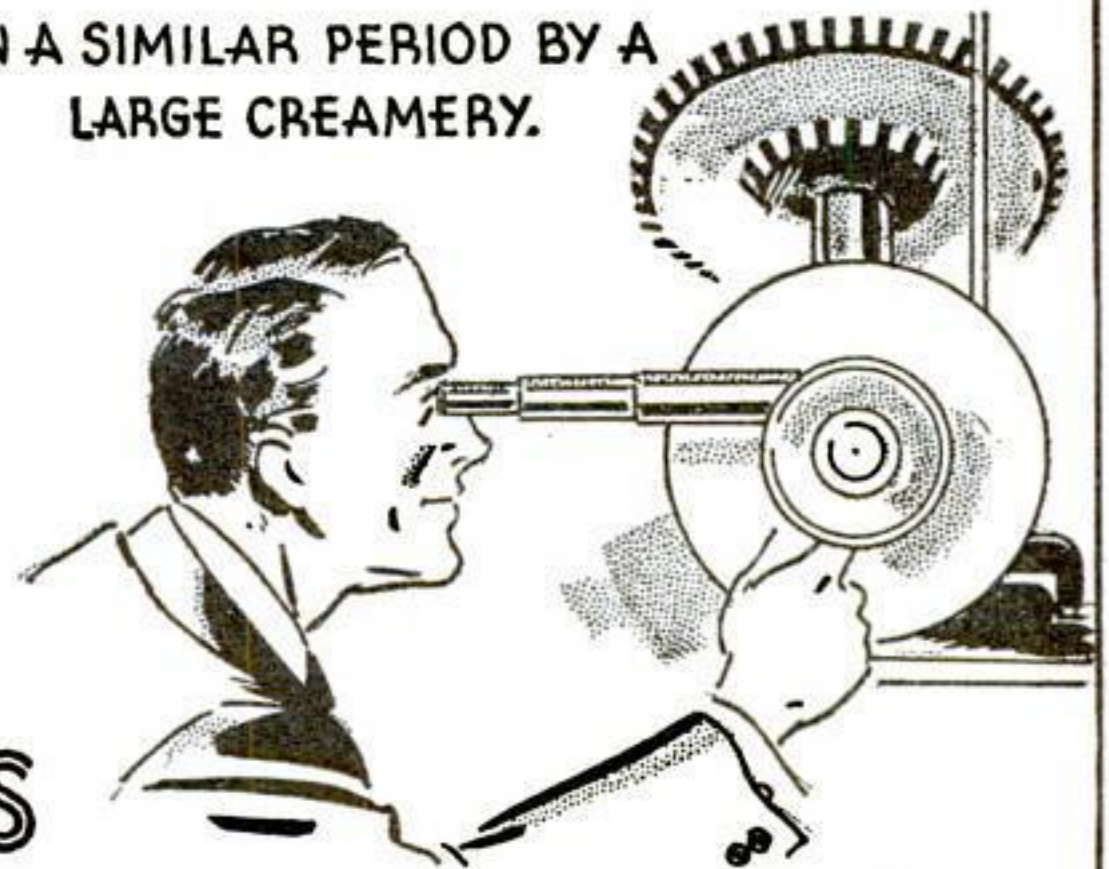
After the front and sides of the drawer are grooved, the front is clamped to the face of the uprights, the lower edge of the front being in contact with the baseboard. The sides are then nailed and glued to the front while their lower edges also are in contact with the baseboard. The sides and front are then squared and braced with temporary diagonals. When removed from the jig, the drawer will be square and true in every way, and ready to receive the bottom and back as soon as the glue has set.—C. F. BLAKE.

OIL PROLONGS RAZOR'S LIFE

MEN who use metal safety razor blade sharpeners will find that a drop of lubricating oil well rubbed over the surface will improve the shaves considerably and prolong the life of the blade.—ARTHUR B. WEEKS.

DID YOU KNOW- INTERESTING AND UNUSUAL FACTS ABOUT PAINT

MORE ICE IS USED DAILY IN THE MANUFACTURE OF PITTSBURGH PAINTS THAN IS CONSUMED IN A SIMILAR PERIOD BY A LARGE CREAMERY.

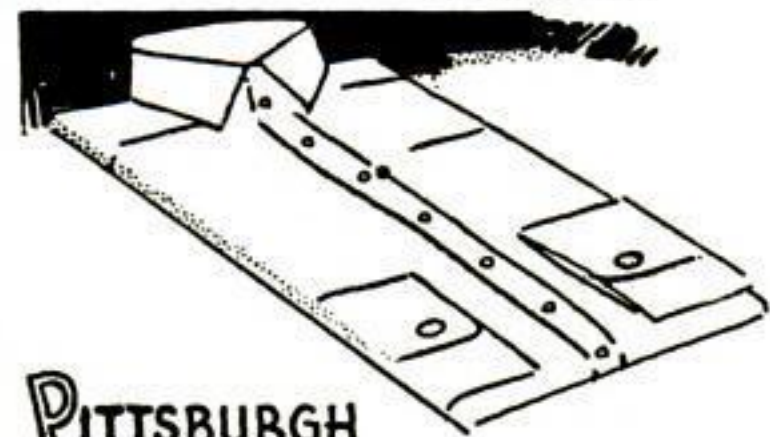


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ARE USED TO WEIGH THE COLORS OF PITTSBURGH PAINTS SO THAT SUCCESSIVE BATCHES ARE ABSOLUTELY UNIFORM.



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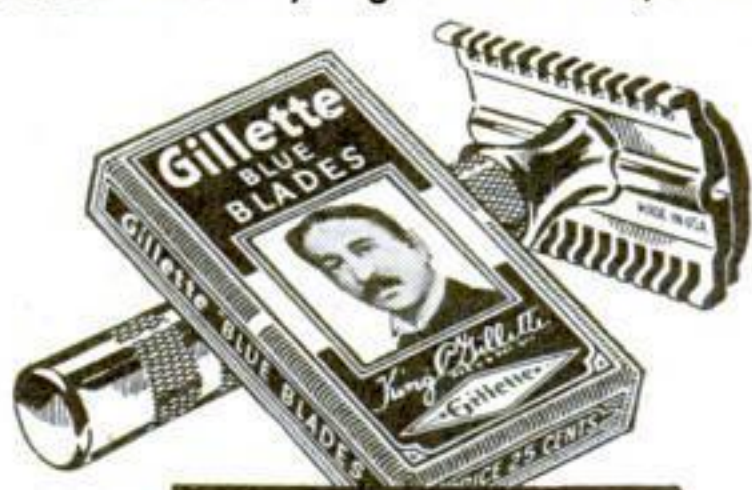
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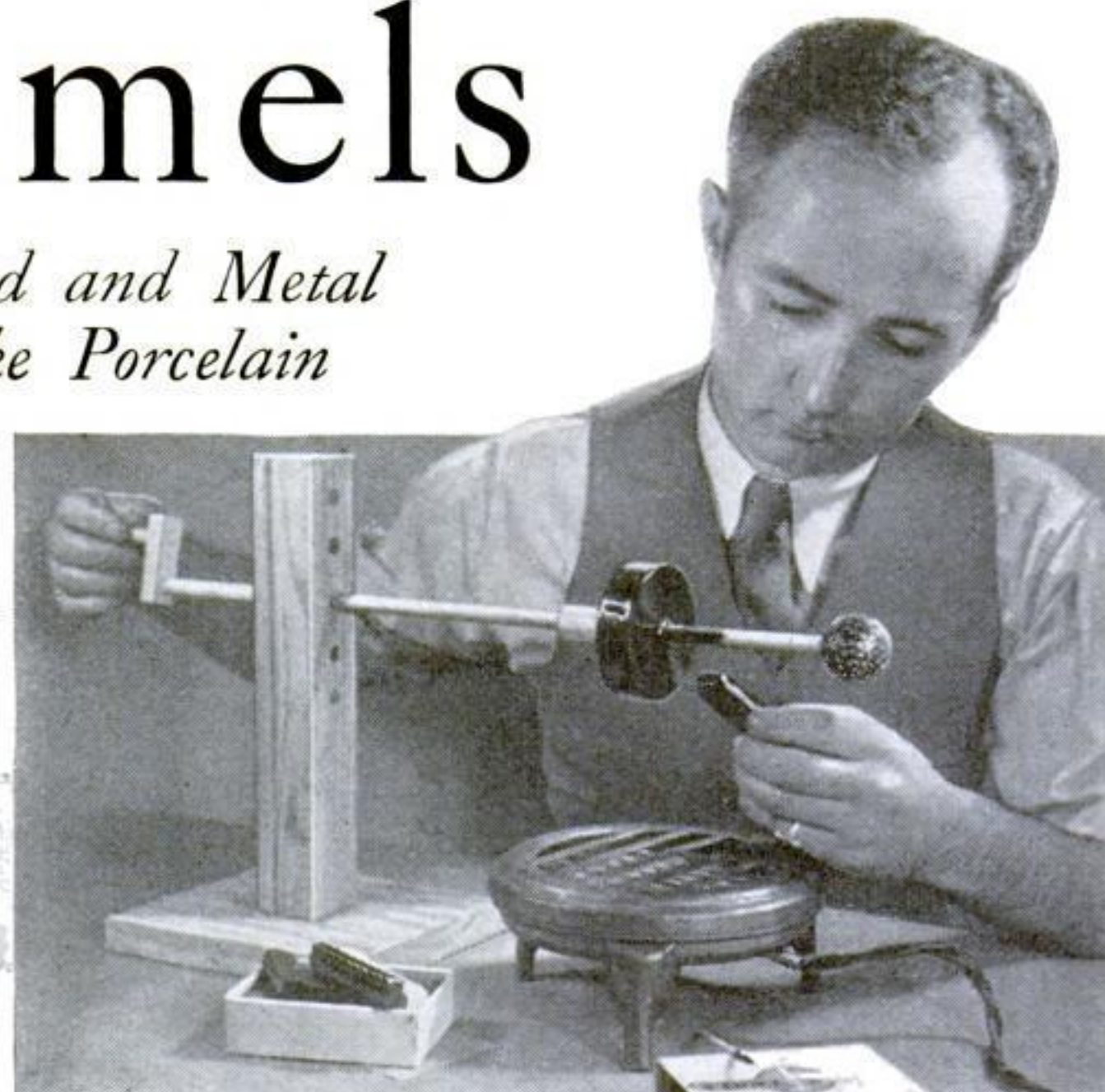
Gillette Blades

Precision-made for the *Gillette* Razor

BRILLIANT NEW Enamels

Make Wood and Metal Look Like Porcelain

By Kenneth Murray



Applying the enamel in stick form to a small wooden novelty over a hot plate. Left: Powdering enamel in a mortar. Note the celluloid guard

THE brilliant, lasting, hard-glaze finish on bathroom fixtures and electrical refrigerators is obtained by fusing a form of powdered glass to the metal with intense heat. Without special equipment, such as an expensive electric oven, this would be difficult to do in the workshop. A new form of enamel that requires a relatively low heat is now on the market, however, and even first trials in using it show surprising results. It is made in stick form, and a dozen brilliant colors are available. In appearance a second cousin to high-grade sealing wax, it can be used on both wood and metal, on plaster, or on compositions. To the touch it is as hard and shiny as the finest porcelain, and articles finished with it retain this appearance indefinitely, although it cannot, of course, withstand severe knocks as well as the commercially applied enamels.

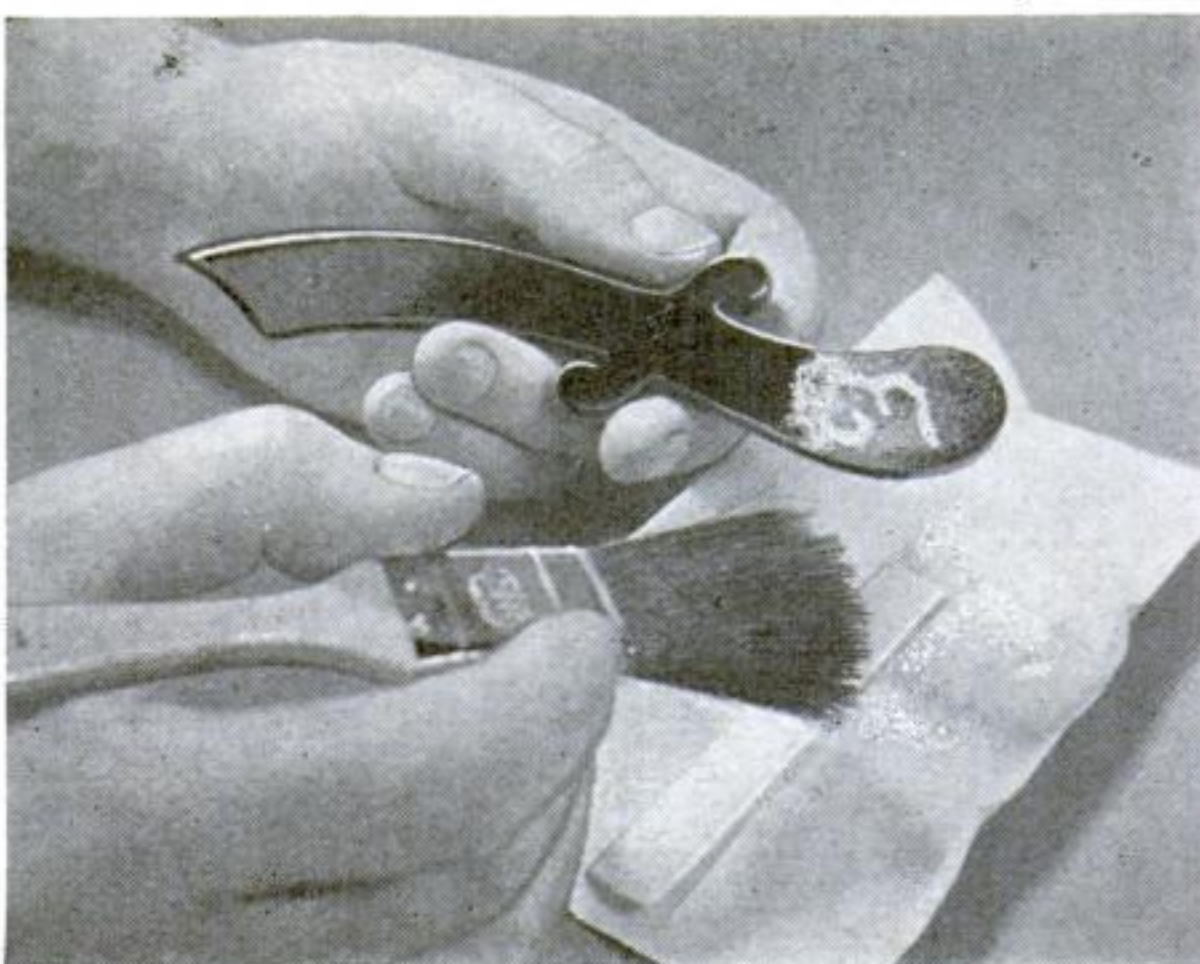
While it is possible to apply this type of enamel by hand with an alcohol flame, the writer found the clean heat of an electric hot plate to be better. For round and irregular wood or metal objects, the hot plate is used with the turning device shown. This is merely a 2 by 2 by 15 in. upright screwed to a wood base, with holes at different heights to accommodate a length of wood dowel which has a crank at one end and a screw at the

other. By attaching the article to the screw point, it can be rotated so that the enamel will go on in a smooth, even film.

The object should be near enough to the hot plate to fuse the stick of enamel, but not close enough to cause it to drip. Turn the crank handle until the object is evenly heated, then rub the enamel against it and continue the rotation until a thick enough coat has been applied. The enamel can also be spread out like butter with a small round stick. This will leave marks, but they will disappear if the article is rotated over the heat for a short time. If the enamel shows the slightest sign of air bubbles, it is too hot.

A flat object can best be enameled by holding the heater, upside down, directly over it. A better way is to fasten the heater to a support such as a drill-press chuck. The distance between heater and work can then be minutely adjusted and measured by means of the gage on the spindle shaft.

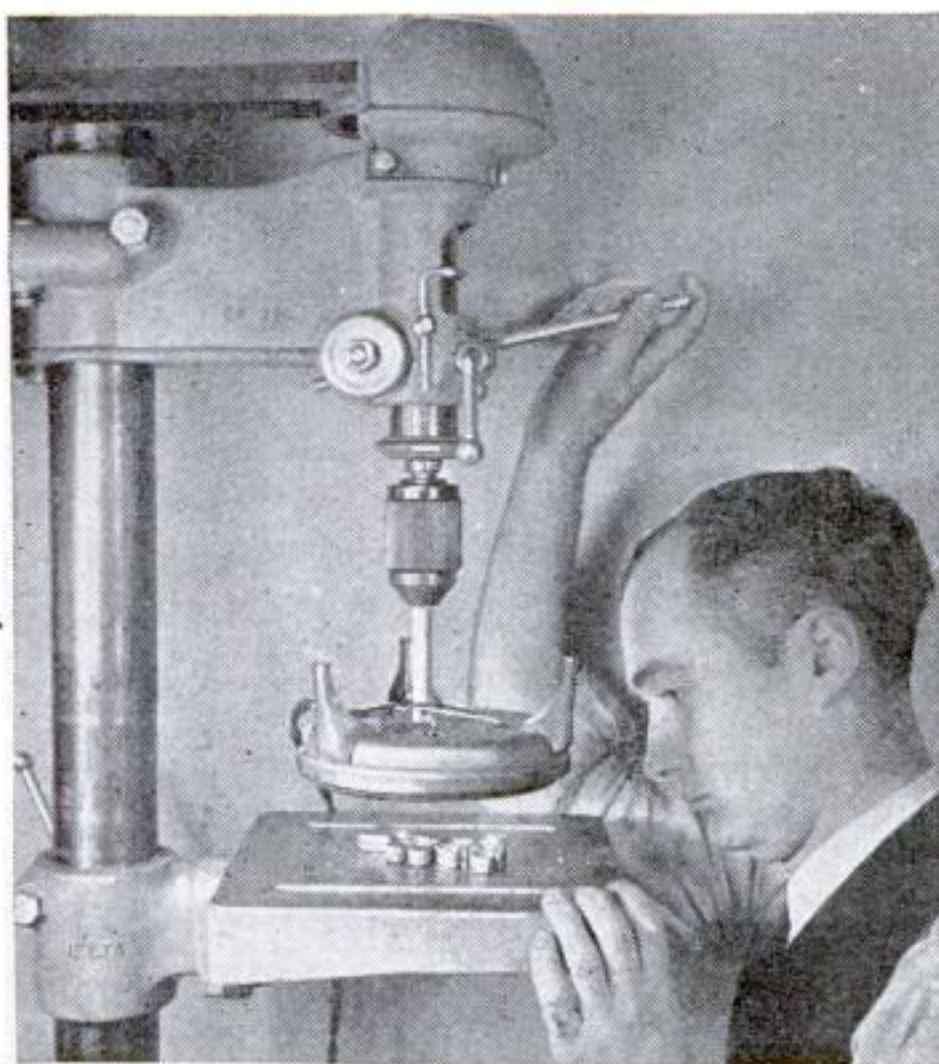
The same method of application may be adopted for the decoration, overlaying, and inlaying of any wood or metal object. An interesting project is to make an enameled statuette from a cartoon drawing. The figure is cut on the scroll saw from plywood and given a coat of [\(Continued on page 103\)](#)



Maple letter opener. The enamel was applied to the initial in a pulverized form as shown at left

BRILLIANT NEW ENAMELS

(Continued from page 102)



Flat work may be heated evenly by attaching the hot plate to the spindle of a drill press

shellac. While this is drying, powder the requisite quantity of different colored enamels in a mortar. Place a sheet of celluloid over the pestle so that chips and particles of enamel will not fly out and be lost. Store each color in an envelope.

It is best to work with one color at a time. With a fine brush apply a coat of shellac to all parts of the figure that are to receive the first color. You can then pour the powdered enamel over the figure and it will adhere on the shellacked parts. Gently brush off any on the other parts. Repeat the operation with other colors until the figure is covered. Allow the shellac to dry thoroughly before fusing, otherwise it will boil when heat is applied. Use a slow heat and plenty of time, and the surface will slowly fuse together and flatten out without danger of the colors' running together. If necessary, you can afterwards re-touch the figure with shellac and enamel powder. The finished work resembles a piece of handmade chinaware.

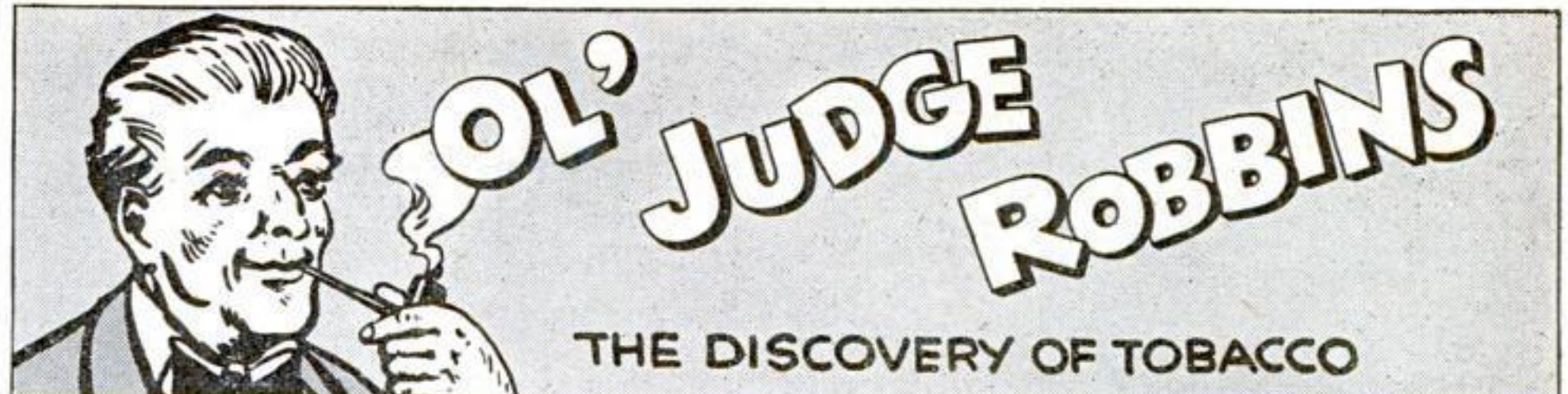
In using the powdered enamel, any kind of design, lettering, or decoration may be carried out. As an example, the making of a wood letter opener is illustrated. Cut the opener from a piece of 3/16-in. hard maple and sand down the cutting edge and point until they are quite sharp. The other edges may be rounded. Enamel the entire piece and then, with a pointed brush, draw the initial on the handle with ordinary shellac. Sift on the powdered enamel in a contrasting color, and gently brush off the surplus. When the shellac has had time to dry, the initial can be fused under the hot plate.

Metal objects do not require a sizing coat. Any high spots of enamel may be filed off, and a little heat will restore the glaze.

TINY C-CLAMPS MADE FROM EARRINGS

EARRINGS having a screw-thread adjustment, which may be purchased at the ten-cent store, serve admirably as miniature C-clamps. They are useful in gluing small parts for model airplanes, boats, ships, and similar projects.

The ornaments, of course, should be removed. Flatten the clamp by pinching with flat-nosed pliers, and file the rounded head of the screw to a square surface.—J. H.

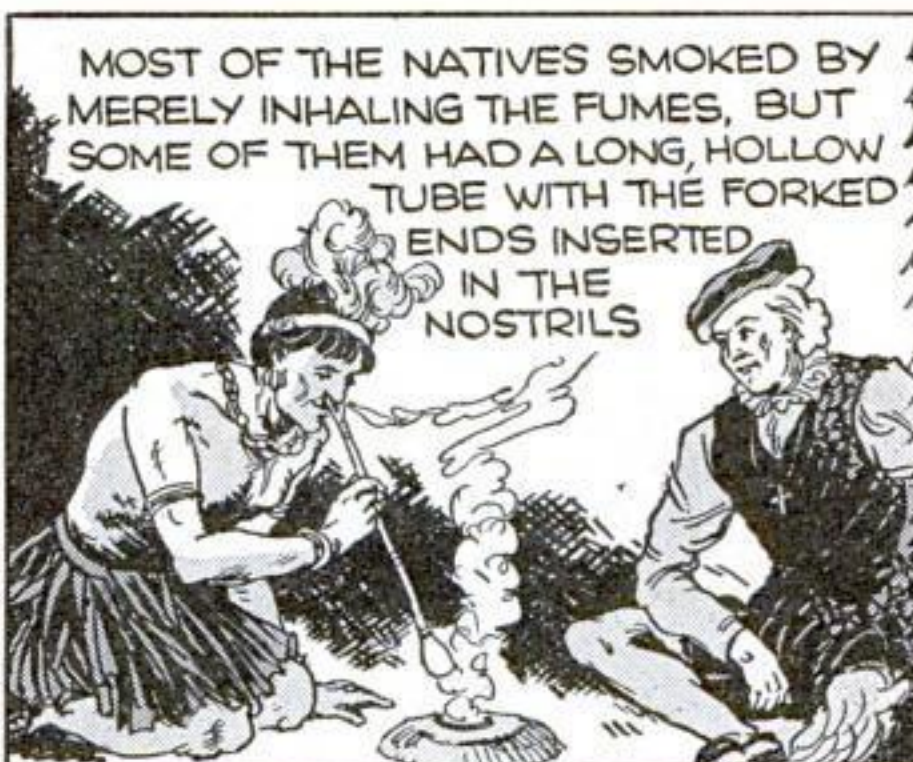


PHOOEY ON THIS WEATHER. I'D GIVE UP ANYTHING, EVEN MY PIPE, IF I COULD BE WARM AND CLOTHES-FREE LIKE THOSE SAVAGES COLUMBUS DISCOVERED

SURE—BUT WHY GIVE UP YOUR PIPE?

BECAUSE MY PIPE IS IMPORTANT TO ME—AND THOSE WEST INDIAN NATIVES DIDN'T KNOW ANYTHING ABOUT TOBACCO

THAT'S WHERE YOU'RE WRONG THEY WERE SMOKING WHEN COLUMBUS DISCOVERED THEM

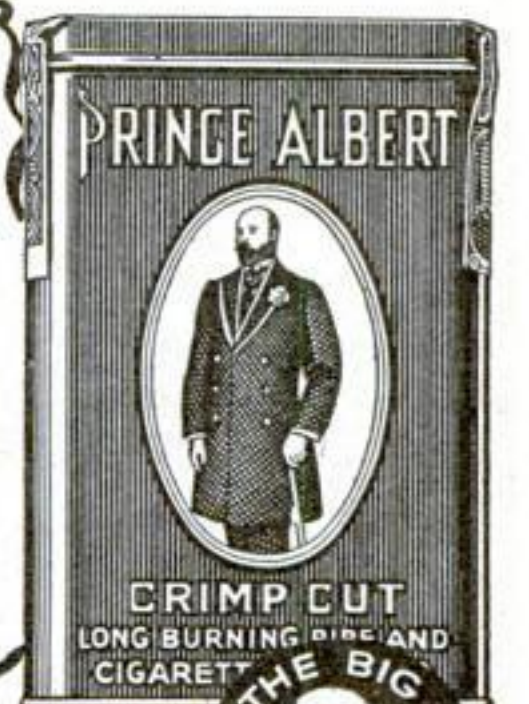


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SMOKE 20 FRAGRANT PIPEFULS OF PRINCE ALBERT. IF YOU DON'T FIND IT THE MELLOWEST, TASTIEST PIPE TOBACCO YOU EVER SMOKED, RETURN THE POCKET TIN WITH THE REST OF THE TOBACCO IN IT TO US AT ANY TIME WITHIN A MONTH FROM THIS DATE, AND WE WILL REFUND FULL PURCHASE PRICE, PLUS POSTAGE. (SIGNED) R. J. REYNOLDS TOBACCO COMPANY, WINSTON-SALEM, NORTH CAROLINA



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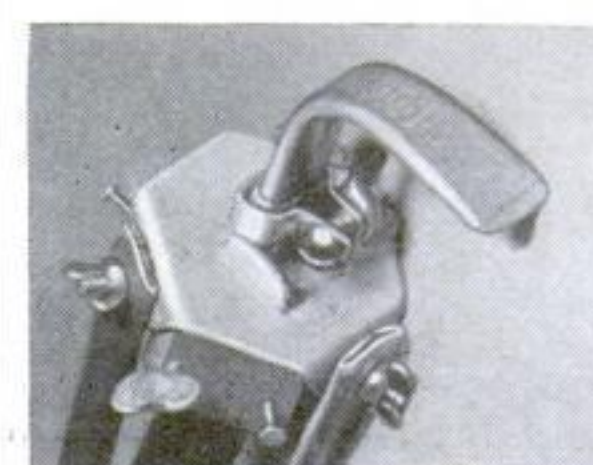
LOW-COST LAMP STAND FROM CURTAIN RODS

(Continued from page 96)

the legs, having the leg seams inside, and the wing nuts will lock them rigidly. Incline them about 30 deg. with the vertical, but adjust them to bring the head fairly level. Then add stops to the head block, to indicate the open positions of the legs. The photographs show nails used for this purpose, but they have not been entirely satisfactory and are to be replaced with 1/4-in. hardwood dowels. The object of the stops is not to prevent the legs from slipping, for they are securely clamped by the screws, but to speed up the setting of the legs. The legs are simply swung around from the closed position as far as they will go, then tightened with the nuts.

The complete curtain rod is used without alteration other than the addition of a clamp clip. Insert it in the tripod head with the outside section down. To clamp it, make a wing screw from a flathead wood screw by drilling the center of a sheet-metal square, slipping it up to the head, and folding it back into wings. Solder the wings fast. The position of the screw in the tripod head enables it to press against the edge of the rod, where no crushing that might bind the sliding section can take place.

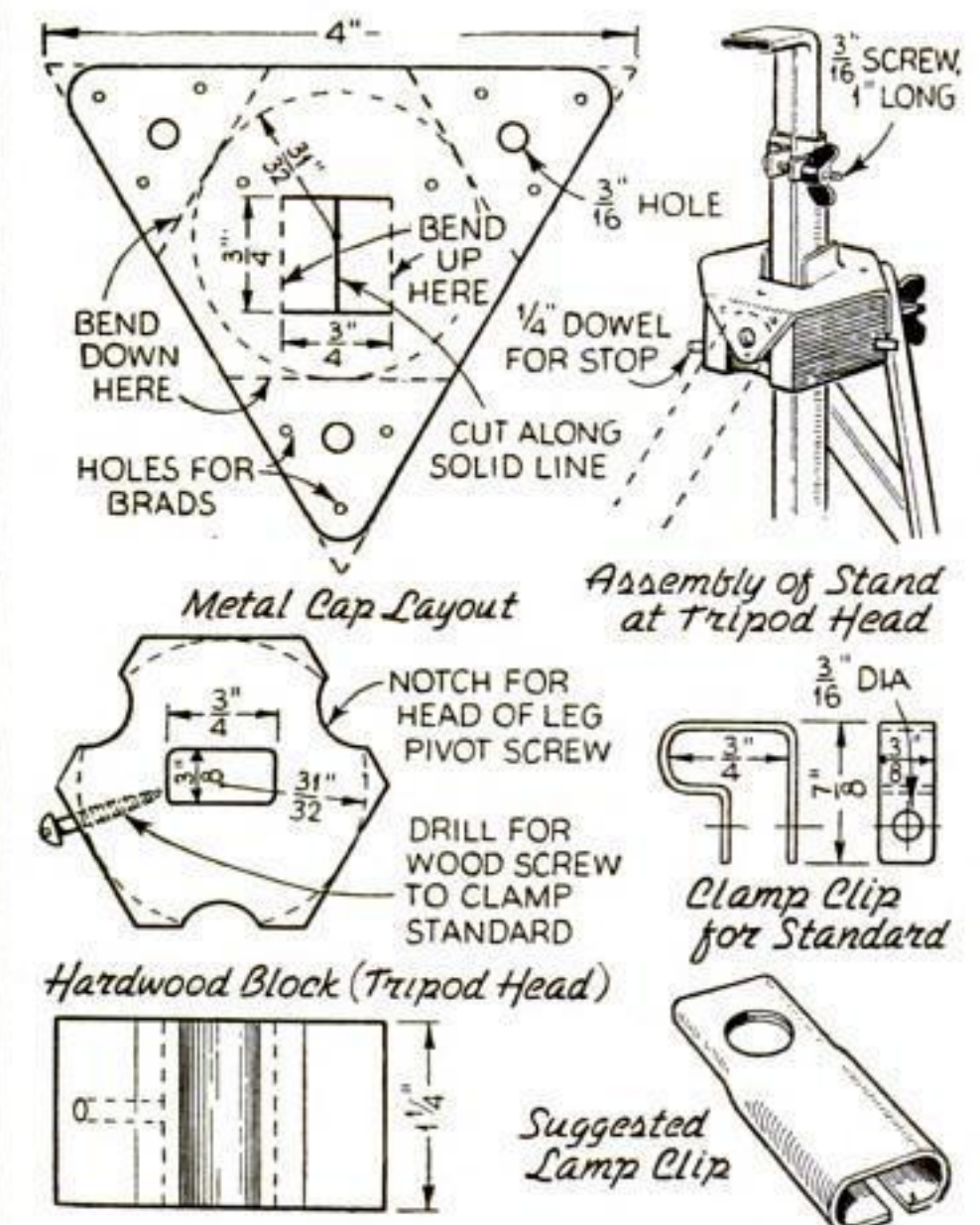
Make the clamp clip for the standard from



The lamp can be attached or detached from the curved-over end of the standard in a second's time. The whole stand is easily folded up into a compact bundle

a strip of metal, and slip it over the square end of the lower section of the rod, soldering it there. This completes the stand.

The method of attaching the lamp will vary according to the type used. A convenient style is that in which the reflector is carried by a receptacle mounted on a ball-and-socket base. Remove the (Continued on page 105)



How to make the tripod head, the clamp clip for the standard, and the lamp attachment

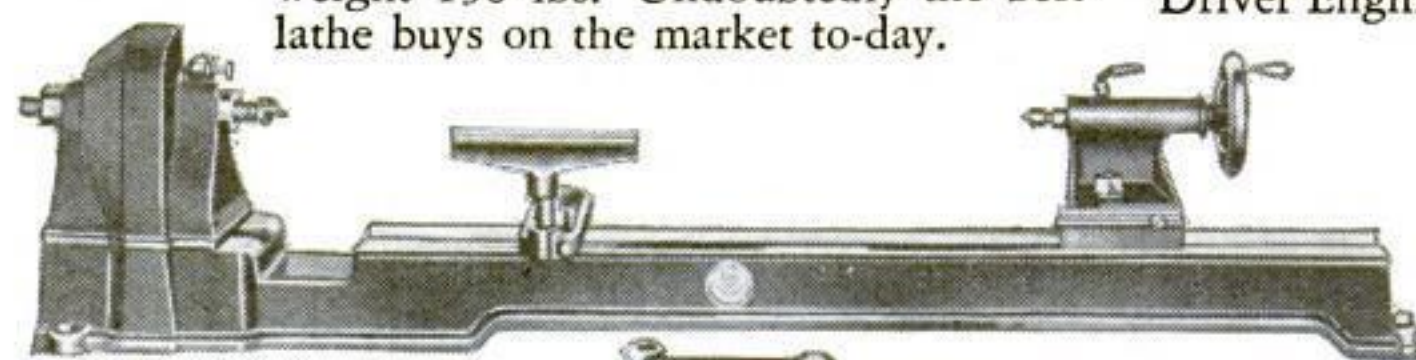
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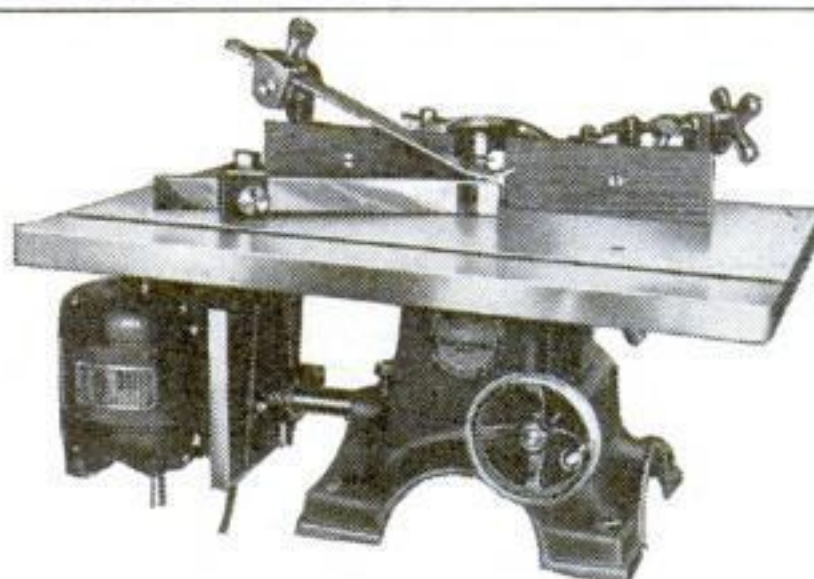
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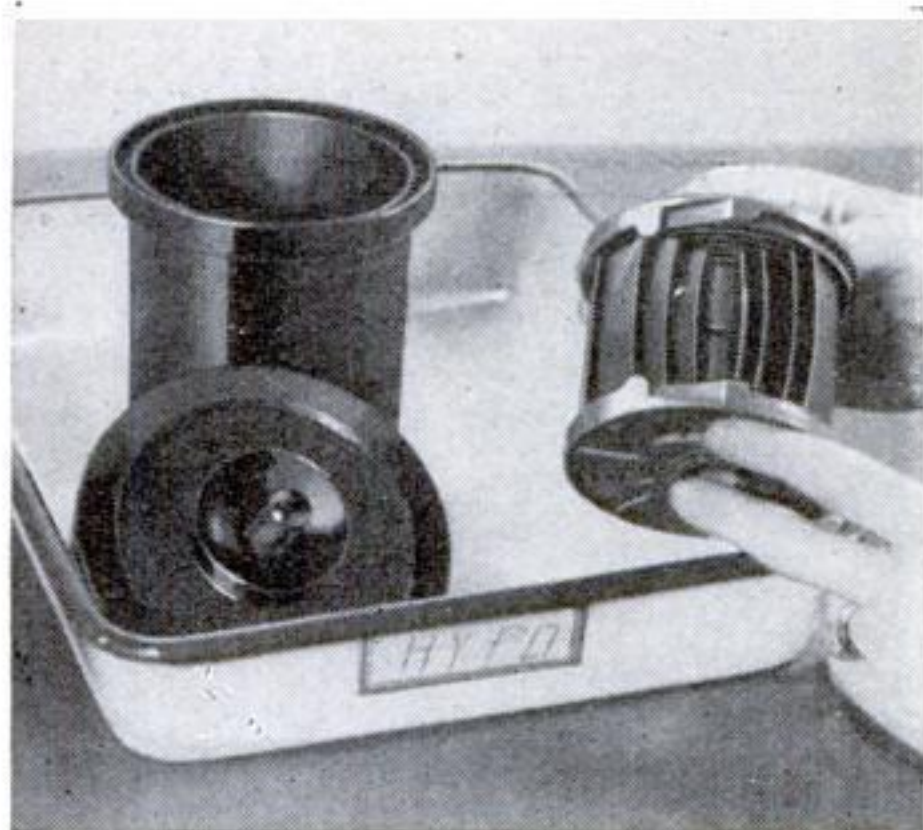
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Making use of the tank to develop cut films

MODERN ROLL-FILM TANK SERVES MANY PURPOSES

MODERN developing tanks of the type illustrated, which have an adjustable composition reel for various sizes of roll film, can be made more useful by taking advantage of the following hints:

When one roll has been developed, the reel must be completely dried before another roll can be threaded into it. To speed the drying, dip the reel in alcohol and place it in a draft of air for a moment or two. If several rolls of similar sizes are to be processed, they may be done two at a time by placing the films back to back and threading into the reel in the regular manner. After being developed and fixed for the usual time, they are separated from each other and placed in the hypo for a moment or two until the backing dye has been dissolved from those portions of the films which were in too close a contact for the hypo to reach during the regular fixing period.

Those owning a cut-film camera as well as a roll camera may use this tank for the cut film also, providing the films are not too large. This is an advantage because of the small amount of developer the tank requires. Up to about eight cut films may be placed in the reel by the method illustrated. Inserted in this way, the film ends, which tend to bow out, do not touch the adjacent film.

Some popular low-priced cameras used a very small, odd-size roll film. Four of these rolls can be developed at one loading by disregarding the regular adjustment nicks on the spindle and adjusting the reel until it fits the roll. Each roll is inserted in turn as far as it will go.—R. L.

STORING MINIATURE NEGATIVES

To PREVENT miniature negatives of the 35-mm. type from becoming scratched when stored away, they may be kept in small aspirin tins. Do not pack too many negatives in one tin, especially if they have a fine-grain emulsion. A piece of blotter moistened occasionally with a drop of water will keep the films flexible.—WALTER A. THOMPSON.

LOW-COST LAMP STAND

(Continued from page 104)

clamp nut under the base of the receptacle and take off the base. Then bend a piece of brass to slide snugly over the bent-over end of the standard rod, flatten one end, and drill it to receive the socket attachment. With this arrangement the lamp can be slipped off or on the standard in a moment. For all very low positions of the light, attach it to the lower bend of the standard.

The stand can be made to reach much greater height by substituting a longer rod for the standard, and using complete rods for the legs. In this case, provide each leg with a clamp clip like that for the standard.—L. K.

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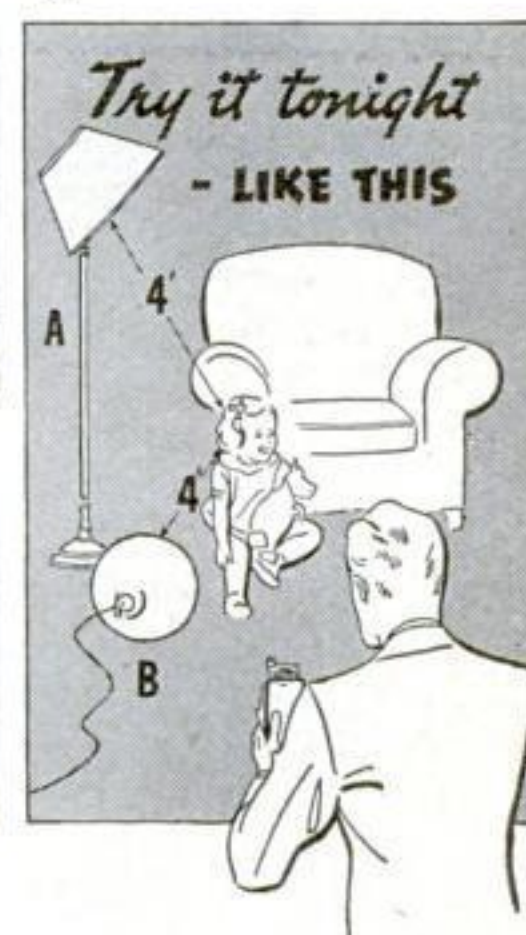
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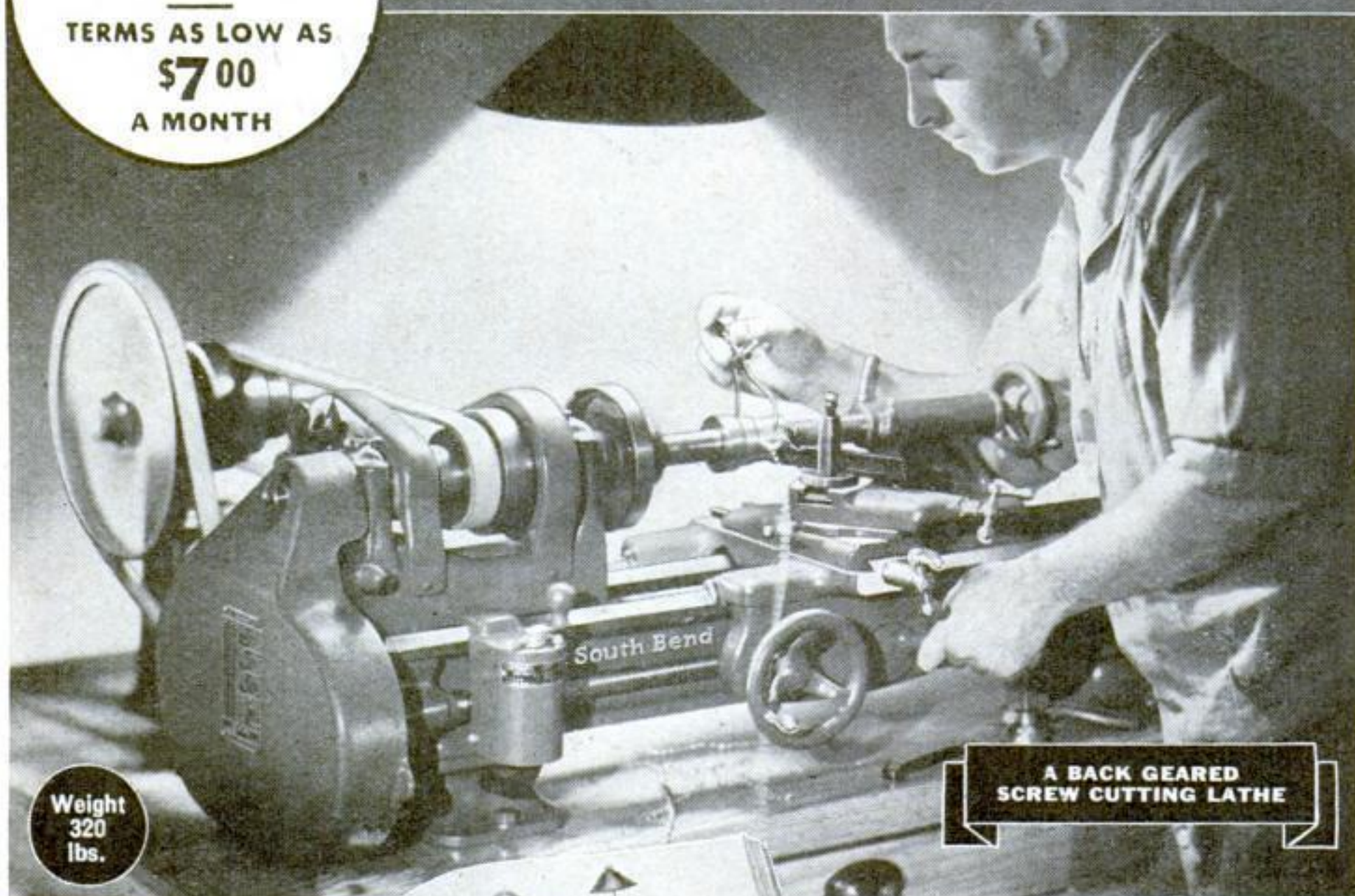
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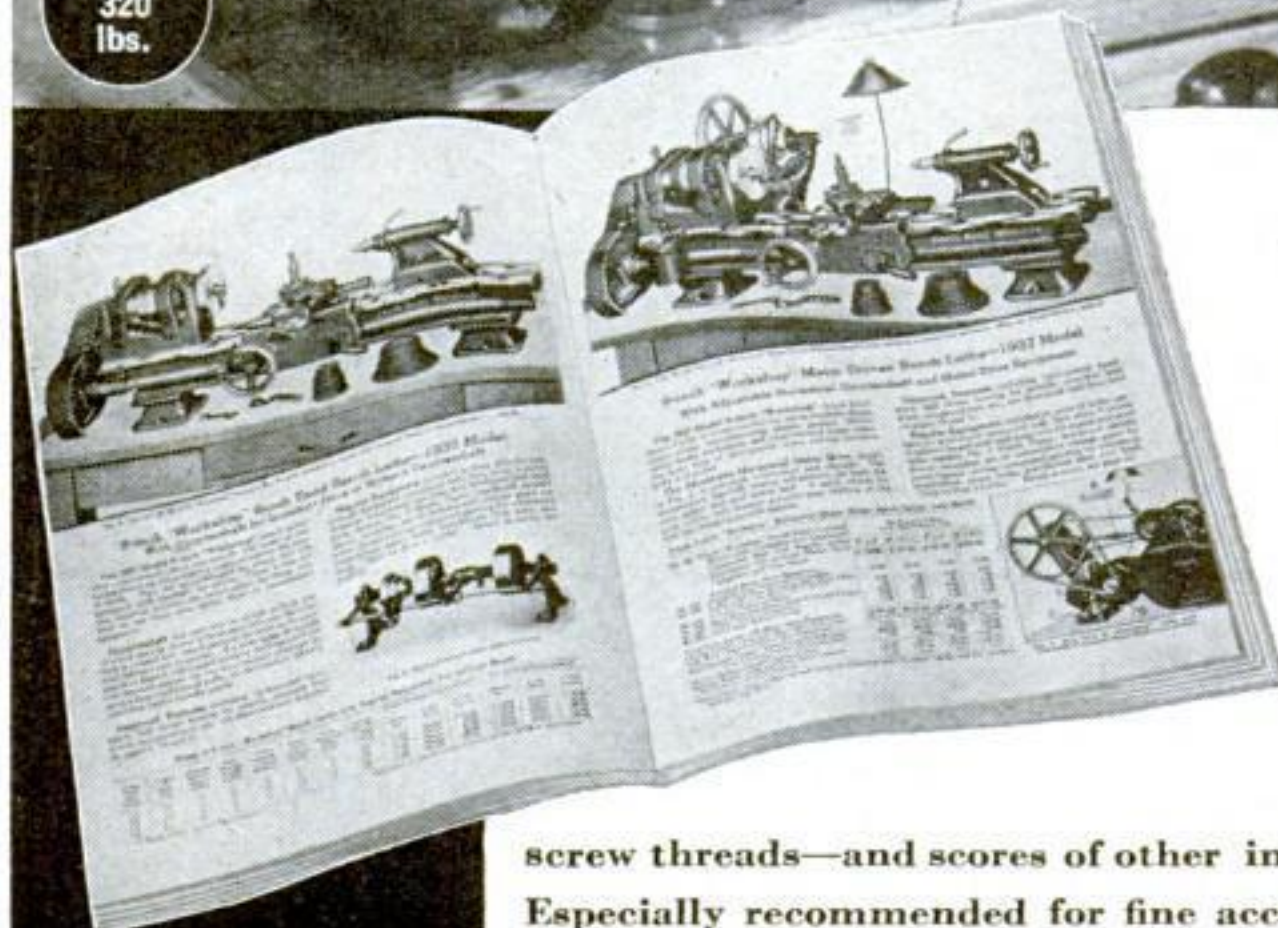
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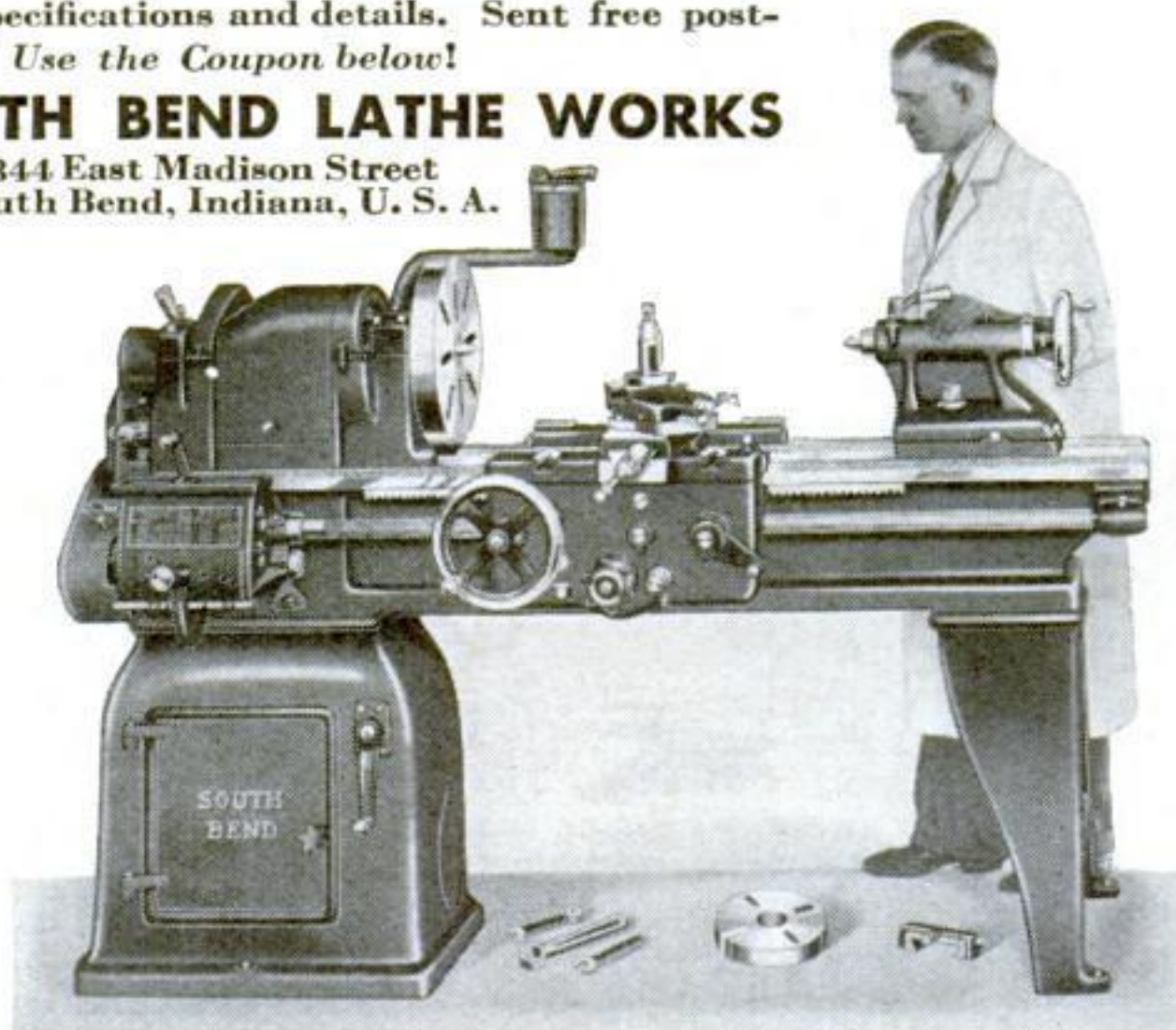
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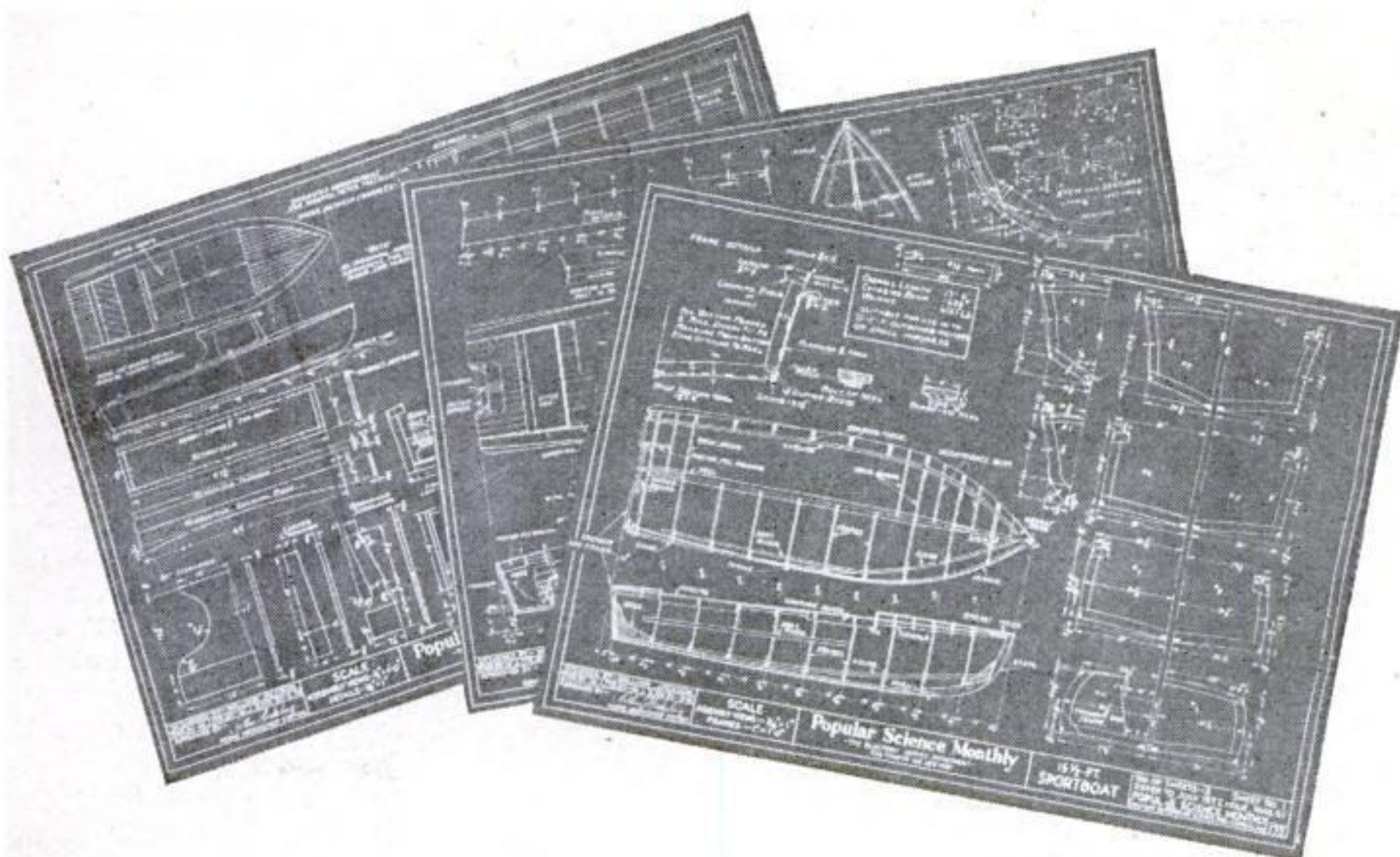
PILL-BOX CAP FOR LENS PRODUCES ODD PHOTOS

PHOTOGRAPHS of a distinctly unusual character can be made with the aid of a simple camera lens attachment. Obtain a circular cardboard pill box of a size to fit snugly over the camera lens. Cut away the excess cardboard until the bottom of the box can be pressed against the front lens flange. In the center of the bottom, draw a circle the same diameter as the visible lens glass. Draw a line through the center, and divide this diameter into three equal parts. With a sharp knife, cut away the two outer segments thus marked, leaving an opening the size of the lens, with a strip extending across the middle. Blacken the interior with India ink. Place this cap on the camera lens with the strip vertical. Open the lens diaphragm as wide as possible, and double or triple the exposure.

When the camera is focused accurately on the object to be photographed, that object will be in sharp focus, but objects in the foreground and background will present a peculiar double appearance. The whole effect is to throw the in-focus object into sharp relief, giving the print a three-dimensional appearance, as is illustrated above. Such photographs are more natural because the human eyes normally see that way.—**WALTER E. BURTON.**



After the inside has been painted black, the cap is placed on the camera in this position



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DON'T delay too long in planning to make those things you will want to use this summer. Perhaps it is a boat for your camp, a sportsman's trailer, or an arbor and gate to dress up your garden. Now is the time to begin construction. A glance through the blueprints listed below will give you a variety of ideas or, better still, send a stamped, self-addressed envelope for our complete list.



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High-Speed Boat for Small Outboard Motors (7 ft. 11 in. long), 257	.25
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Outboard Racer for Class "A" and "B" Motors, (10 ft. 4 in. long), 211-212-R	.75
Runabout Sportboat (15½ ft. long with detachable top, seats that fold into bunks, etc.; for use with outboard or inboard drives), 175-176-177-R	1.00
Utility Rowboat, 13-ft., (can also be sailed or driven by outboard motor), 224-R	.50



RADIO SETS

All-Wave Portable Receiver (two tubes, operated by battery), 217-R	.50
Amateur Short Wave Receiver, 155	.25
Amateur Radio Transmitter, 183-184	.50
Five-Tube Short Wave (A.C. or D.C.), 223	.25
Full Electric Headphone Set, 130	.25
One Tube (battery operated), 103	.25
Screen-Grid Set, 109	.25
Short-Wave Converter Unit, 137	.25



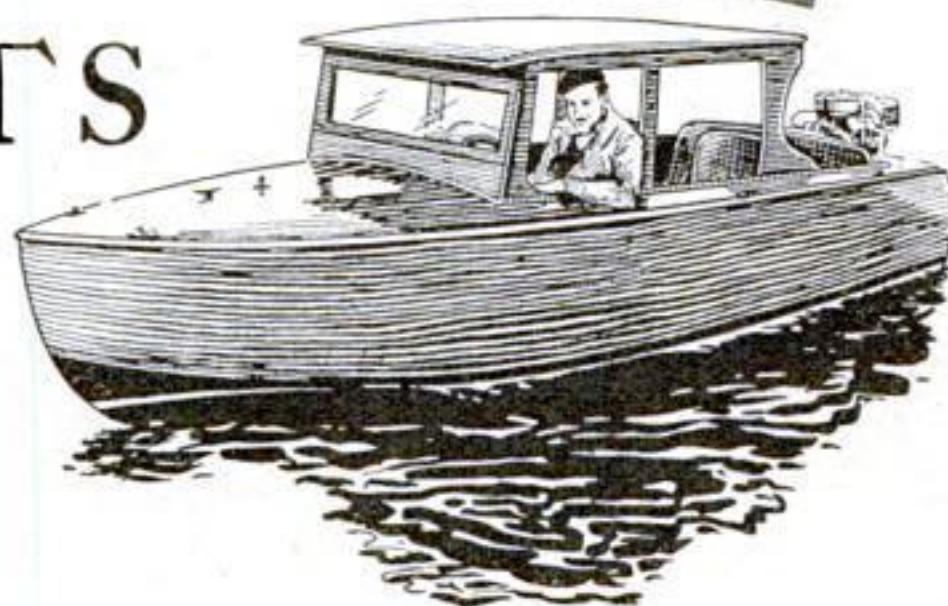
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Cabinet, Smoking, 2	.25
Coffee Table, 245A	.25
Colonial Writing Desk, 21	.25
Combination Bench and Tilt-Top Table (no turning), 11	.25
End Table, American Empire, 241A	.25
Folding Screens, Four Modernistic, 91	.25
Gate-Leg Table with Round Top, 24	.25
Modernistic Book Ends, Low Stand, and Bookshelf, 100	.25
Queen Anne Dressing Table, Stool, and Mirror, 295A	.75
Reading Tables, Two, 68	.25
Rush-bottom Armchair, 36	.25
Smoking Stand, Modern, 238A	.25
Stool, Upholstered, 240A	.25
Table, Four-Leaf Card, 239A	.25
Telephone Table and Stool, 18	.25
Tilt-Top Table (turning), 140	.25
Treasure Chests (metal bindings), 78	.25
Wastebasket and Magazine Rack, 296A	.25



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Brig, <i>Malek Adhel</i> , (20-in. hull; frame - and - plank construction), 304-305-306	1.00
Clipper Ship <i>Sovereign of the Seas</i> (20½-in. hull), 51-52-53-R	1.00



Blueprints 175-176-177-R (price \$1.00) give complete details for this 15½-ft. runabout

Clipper Ship in a Bottle, 121-122	.50
Coast Guard Patrol Boat (20½-in.), 286-287-R	.75
Cruiser U.S.S. <i>Indianapolis</i> (12-in.), 216	.25
Farragut's Flagship <i>Hartford</i> (33½-in. hull), 221-222-R	1.50
Freighter, Ocean (14-in.), 271	.25
Galleon <i>Revenge</i> (25-in.), 206-207-208-209	1.00
<i>Hispaniola</i> (7-in.), 237	.25
H. M. S. <i>Bounty</i> (8½-in. hull), 254	.25
Liner— <i>Queen Mary</i> (10¼-in.), 283	.25
<i>Nourmahal</i> , power yacht (8½-in.), 276	.25
Oil Tanker (14-in.), 294	.25
Racing Yacht <i>Seascout</i> (42-in.), 106-107-R	.75
Roman Galley (19-in.), 138-139-R	.75
<i>Sea Witch</i> , Clipper Ship (9½-in. hull), 219	.25
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Stagecoach with Horses, 144-145-146-R	1.00
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Viking Ship (20½-in.), 61-62-R	.75
Whaler— <i>Wanderer</i> (20½-in.), 151 to 154	1.00
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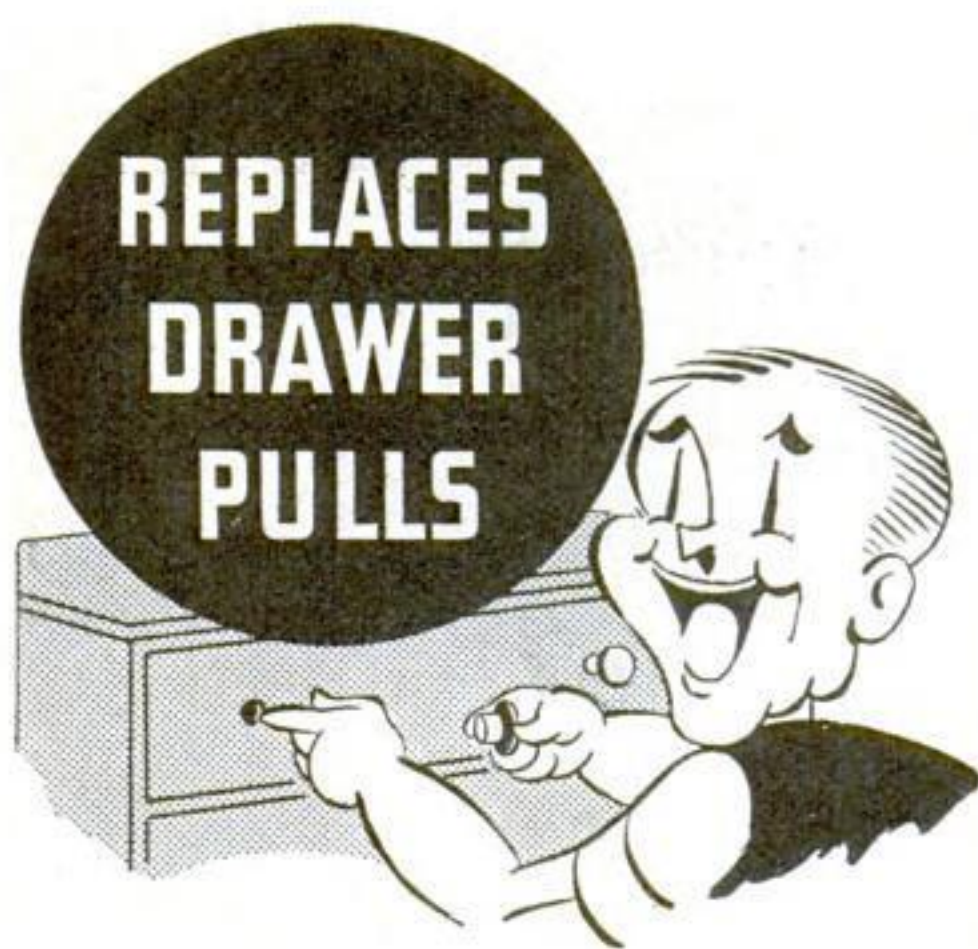
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CIRCUS SCOUT FINDS NEW THRILLS FOR THE BIG TOP

(Continued from page 39)

his shoulder, and another climbed aloft to do balancing tricks. There was nothing else to do on perch poles, the performers said.

But Valdo scoured Europe and brought to America the Walkmirs, the Four Polis, the Antelaks and the Willos, who have revolutionized perch-pole acts. The Walkmirs' principal stunt has the man of the trio balancing a pole on his forehead while two girls, of exactly the same weight, climb to the top of the pole where there are duplicate trapeze bars. They hurl their bodies in swift revolutions around the bars in muscle grinds. Should one of these girls hesitate for a fraction of a second, she would throw the pole off balance and send it hurtling to the ground.

AND while Valdo tells of the new feats formed under American big tops, he takes particular delight in telling of the Naittos, Chinese tight-wire artists, whom he considers his greatest finds.

A number of years ago, the circus featured in its center ring a balancing act in which one girl stood on her head on the head of another, who walked up a flight of stairs, across a platform, and down the steps on the other side of the ring.

But when Valdo went to London last winter, he saw the Naittos in Bertram Mills's circus. Nio Naitto and her sister did just such a trick as the American girls, but instead of walking up steps and across a platform, Nio Naitto walked up steps and across a tight wire, bearing her sister in an upside-down position on her head.

"To my mind, that is the best answer to the question as to whether or not there is anything new in circus acts," Valdo declared.

Not all the new acts imported by Valdo depend upon more difficult feats. Often they are based on ingenuity rather than on surpassing skill.

Merkel, the human fly, is an example. Merkel took his cue from the vacuum cups which are used for many commonplace purposes. He had suction cups of large size made to attach to shoes, and succeeded in walking upside down on a platform high in the tent.

Another is the Otaris, a German family of aerialists, who present a "flying-return" act from a trapeze frame in the shape of a Maltese cross, outlined in lights. The fliers work crisscross, their evolutions being so timed that they pass each other in the air.

"Any troupe of American flying-trapeze performers could do the same type of act," Valdo said, "but the fact remains that no one has heretofore conceived such a rigging and it is the first innovation in the 'flying-return' act since it was introduced to the circus sixty years ago."

EUROPEAN artists have taken the lead generally in developing mechanical contrivances which enable them to accomplish new feats, Valdo says. In his opinion, the most spine-tingling act that he has brought to this country is that of Mlle. Gillette, a French aerialist, whom he contracted after seeing her perform in a morning rehearsal in the Circus Busch in Berlin.

Mlle. Gillette employs strong cables attached to her ankles and to heavy springs on a platform in the top of the tent. She stands on this platform and leaps to a trapeze twenty feet away, set swinging by an attendant on the ground. When her hands grip the trapeze bar, it breaks, and with a scream she is hurled toward the ground, only to be caught up by the cables. Many a heart misses a beat when the circus crowds see this trick.

Valdo told me that five years ago, an American trapeze performer was in Europe on a

vacation trip and saw Mlle. Gillette's act. There was, of course, nothing like it in this country, so the American woman decided she would undertake it.

But the mechanic who made her rigging overlooked some vital part of the mechanism, and when the woman made her first leap while rehearsing in Madison Square Garden, New York, she fell to the ground, suffering a broken hip and internal injuries that ended her circus career.

VALDO has experienced few serious difficulties in contracting foreign acts for American circuses, except in Russia, where there are more circuses and performers than in any country in the world.

In Russia, he explained, there are 150 circuses, each housed in a permanent building and under government control and management. To obtain performers for these shows, the government conducts circus schools for children from fourteen to eighteen years of age, who are paid salaries while they are learning.

Seeking to contract a Russian act, Valdo was referred by the circus manager to the political director, who in turn consulted regional officials, and they took the matter up with authorities in Moscow. Foreign tours of Russian artists are considered from the standpoint of the cultural value to Russia. Before a final decision was reached, Valdo had returned home and the circus season in this country was under way.

There is only one nation that dominates any particular branch of the circus art, I learned from Valdo—and, oddly enough, it is the United States. He says that America produces more "flying-return" artists than all other countries combined, and with the exception of the Otaris, no acts of this type have been imported into the United States in a quarter of a century.

And Valdo does not overlook his native land when in search of new talent. One of his best features he discovered right under his nose, figuratively speaking, though the artist had developed his act in far-off Japan. He is Koban, the man who "walks upside down" by balancing on his head and jumping up a row of steps. Valdo found him working in a small circus less than 100 miles from the Florida winter quarters of "the greatest show on earth."

LIKEWISE, one of Valdo's most unusual experiences in employing new acts occurred in Kansas. At that time, the circus featured Hugo Zacchini, "the man who is shot out of a cannon." Valdo had been told that a troupe of clowns in a small middle-western circus was presenting a burlesque cannon act. So he went to Kansas and looked up the show. Upon inquiring for the clowns, he was informed they were no longer with the show because their act was "no good." He obtained their home address and sat on the back steps of their house as they made up and went through their comic antics in the back yard. The following week, circus audiences laughed merrily over the big show "kidding" its feature act with the burlesque cannon number, just as the scout had anticipated.

Pat Valdo knows his circus—but, more important, he knows his circus public.

OXYGEN PIPED TO BEDS

A PIPE system that carries oxygen to bed-sides is the latest equipment of a London Hospital. The gas is popularly associated with last-resort treatment of dying persons, and the sight of the steel tanks has often frightened patients unduly. Hence the concealed pipes.

TESTS THROW NEW LIGHT ON TELEPATHY

(Continued from page 29)

electric device which slides them back and forth across baffle plates, the human element is eliminated from this phase of the work.

At least a dozen colleges and universities in all parts of the United States, at this writing, are coöperating in the Rhine tests. In the greatest mass attack yet attempted, they are penetrating into this mysterious realm of psychology.

Much remains to be done. There is, for example, the question of the part that emotion plays in telepathy. One curious occurrence, reported from Harvard University, illustrates the possibilities which may lie in this direction.

DURING one of his experiments, Dr. Estabrooks was using a valued pack of playing cards. As he cut and selected a card, a leaky fountain pen splashed ink all over it, ruining it. The scientist was highly irritated. Later, when he examined the record sheet of the subject, he found the name of this card correctly listed, with a star placed in the margin beside it. The subject said that in this case the impression had come with such unusual force that he had starred the call to see if there had been anything peculiar about the circumstances of the card's selection!

In everyday life, emotion—which is usually absent in cold-blooded laboratory tests—may be the factor responsible for the spectacular occurrences which we are at a loss to explain. It was such an occurrence, Dr. Rhine told me, that started him on his researches.

When he was a graduate student at the University of Chicago, a famous botanist told him this story:

One stormy night, a woman on a mid-western farm dreamed she saw her brother drive into his barn, nine miles away, climb into the hayloft, pull a pistol from his pocket and fire a bullet through his brain. So vivid was the nightmare that she awoke screaming and insisted that her husband drive her over to her brother's farm to see whether everything was all right. There they found the body in the loft. Every detail of the suicide, evidence showed, was exactly as the sister had seen it in her dream!

The botanist was a trained and skeptical scientist. He had lived in the community at the time. He had checked up on the facts first-hand. And he was baffled for an explanation. Even granting that the woman was worrying over her brother's mental condition, how could science explain the fact that the dream was correct in every detail? Was there, after all, some kernel of scientific truth in telepathy, so long travestied by vaudeville fakers and professional frauds?

THAT was the question that haunted Dr. Rhine, the question he set out to answer in his present tests. For more than six years, these experiments have been going on. Climaxing the researches of other scientists, in many parts of the world, they provide the first long-range statistics in the study of telepathy. These advances, reported in recent months, form an important milestone in the study of mysterious and unmapped regions of the human mind.

POTATO EYES FOR SEED TRAVEL BY AIR MAIL

POTATO EYES are now traveling across Canada by air mail. The eyes, from which the sprouts appear, are cut from the potatoes with a minimum of flesh around them and packed with slaked lime to prevent spoiling. In this form, they are much lighter and less bulky than seed potatoes and so can be sent economically by plane.

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No Bite!

Still no Bite!

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WEIGHT OF PASSING TRAIN OPERATES MODEL RAILWAY CROSSING GATE

OWNERS of spring-wound toy railways and even those who have electric train outfits will find it a simple matter to set up realistic automatic crossing gates by the method illustrated at the right. The device requires no electrical connections and draws no current, being wholly operated by the weight of the train. The same principle may be used to operate a switch for electric gates, crossing bells, and various types of signals that otherwise would require considerable wiring.

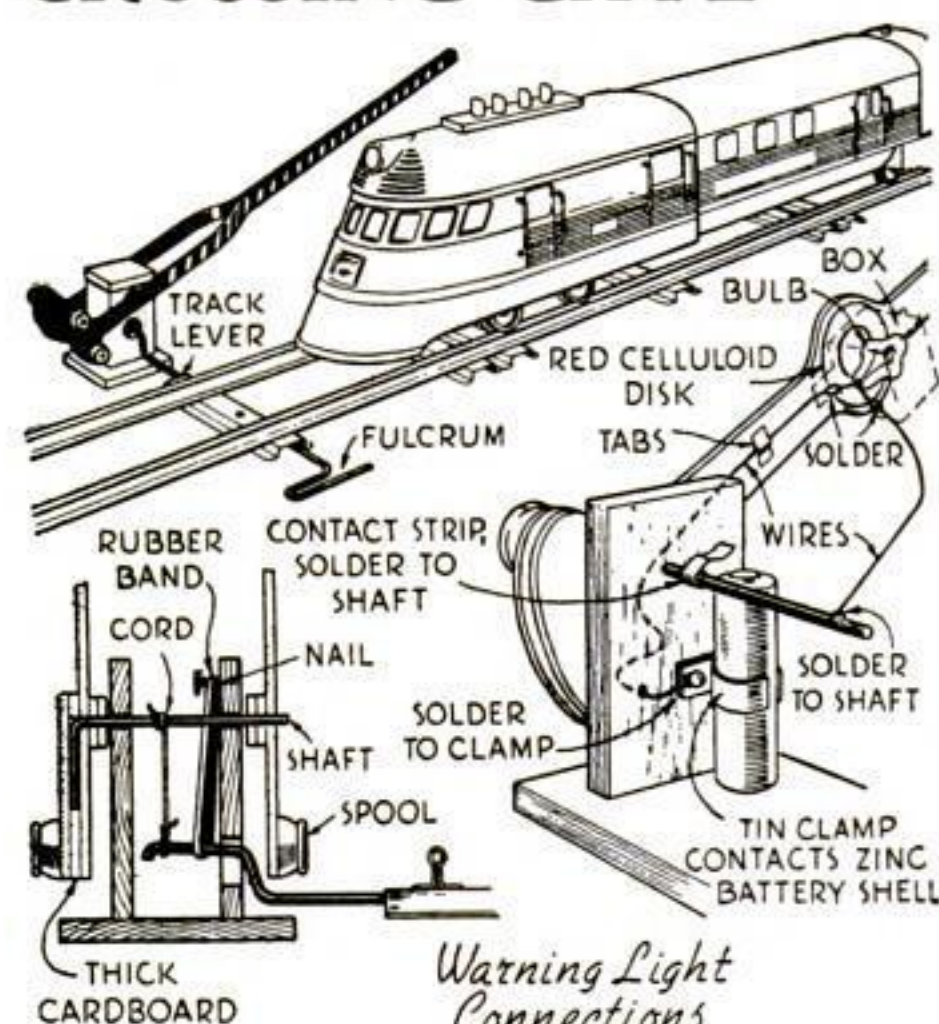
In the case of the crossing gate, a lever, made of coat-hanger wire or other stiff wire, passes under one of the ties and holds it up a short distance from the floor. When the train passes over this tie, the lever is pressed down, operating the gate.

The arms of the gate are carried on a shaft, which may also be made of coat-hanger wire. One end of this shaft is bent down and fastened to the arm with a piece of cardboard glued over it, so that the shaft will turn the arms with it.

A piece of cord, which should have very little stretch when pulled, is tied tightly to the shaft and wrapped around two or three times to prevent slipping. The free end is tied in a loop, which is hooked under the track lever so that, when the latter is depressed, it will pull the cord and turn the shaft, pulling down the arms to the warning position.

The arms are returned to the raised position by counterweights made from small darning-thread spools sawed in half. If the weight of these spools is not sufficient, sections cut from a penny pencil may be glued into the holes.

The counterweights cannot furnish a steady pull in all positions of the arms, so they cannot balance the weight of the track and the



The gate in use, a cross section of the mechanism, and a sketch showing how to add a light

red light in the down position. A small red celluloid lantern is built into it as shown, and inside this is placed a 1.25-volt pen-light bulb. To decrease the weight, the base is removed from the bulb, care being taken not to damage the bulb or the leads to it. Melt the center contact with a soldering iron; then cut the base with a file and peel it off the composition if the other lead cannot be found.

Solder each of the two leads to a piece of enameled magnet wire of about 28 gauge and run one wire down each arm. Solder one wire to the shaft and run the other into the box through a hole drilled for the purpose, leaving a loop to permit the gate to work freely. The free wire is soldered to the clamp holding a small pen-light battery inside the box. A small strip of metal soldered to the shaft will then touch the center contact of the battery when the arms are down, turning on the light.

To balance the additional weight, small plugs are cast from solder to fit into the holes in the spools. The solder may be melted in an old tablespoon over a gas flame. The solder should not be of the flux-cored variety.

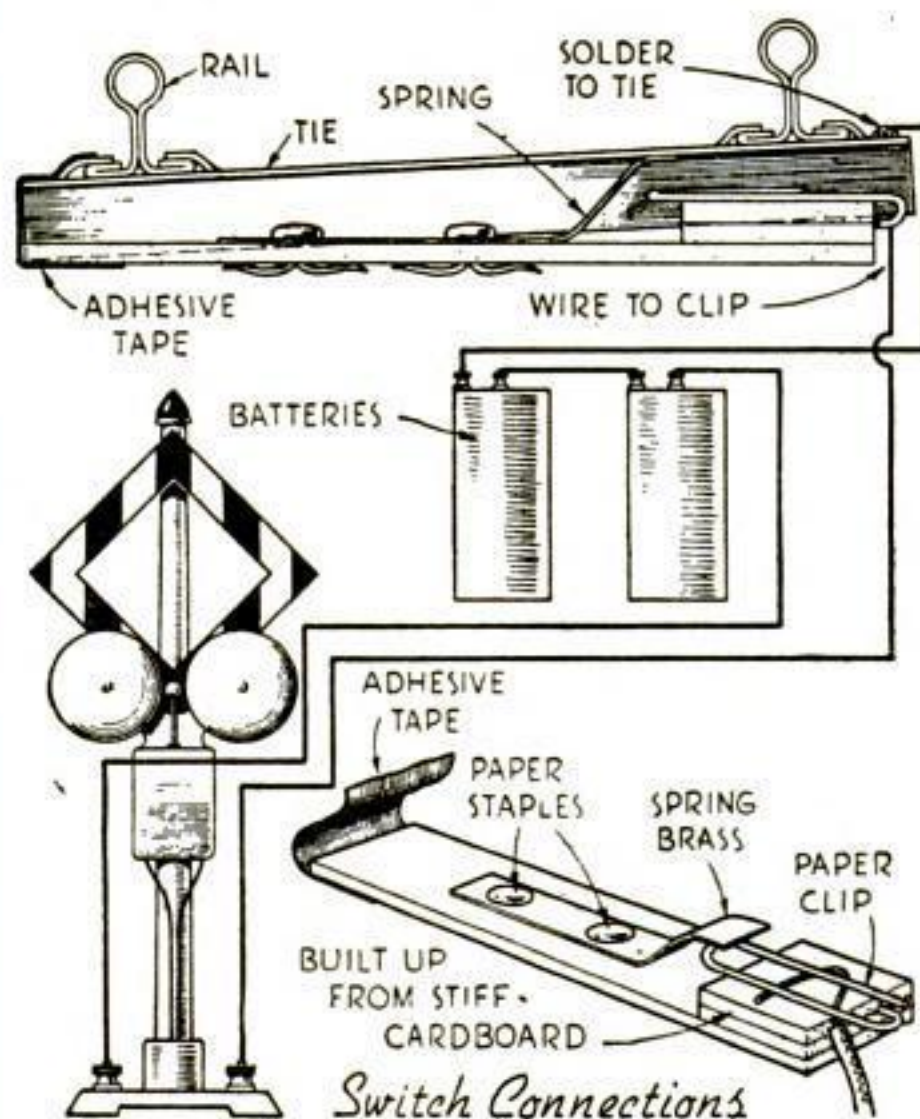
This signal is easier to make and less expensive than an electrically-operated type, yet when properly adjusted, it is extremely sensitive and will come down before the locomotive has reached the "hot" tie.

If the same idea is to be used to operate a switch for turning on various electric accessories, the construction is even simpler. Power for these devices may be obtained, of course, from batteries or a small transformer.

The base of the switch is made of stiff cardboard. It is kept from moving about under the tie by a piece of adhesive tape, which should be painted black for neatest appearance (after it has been stuck to the tie, of course). One side of the track is held up by a stiff piece of spring brass. This forms one contact, and a paper clip forms the other. The weight of the train brings the brass strip into contact with the paper clip, closing the circuit. It is convenient to solder one lead to the track, rather than directly to the spring.

Two kinds of ties are in use, and for the closed-end type, it will be necessary to bend up one end. If the ties stand high off the floor, pieces of cardboard may be glued to the base to raise the paper-clip contact. The clip is slipped over the uppermost piece before gluing.

Tension of the spring to balance the weight of the track may be adjusted by making the strip shorter or bending it away from the other contact. If the brass is not very stiff, the sides of the "hot" tie may be bent up, allowing the give in the track to provide most of the spring action.—JOHN L. STORY.



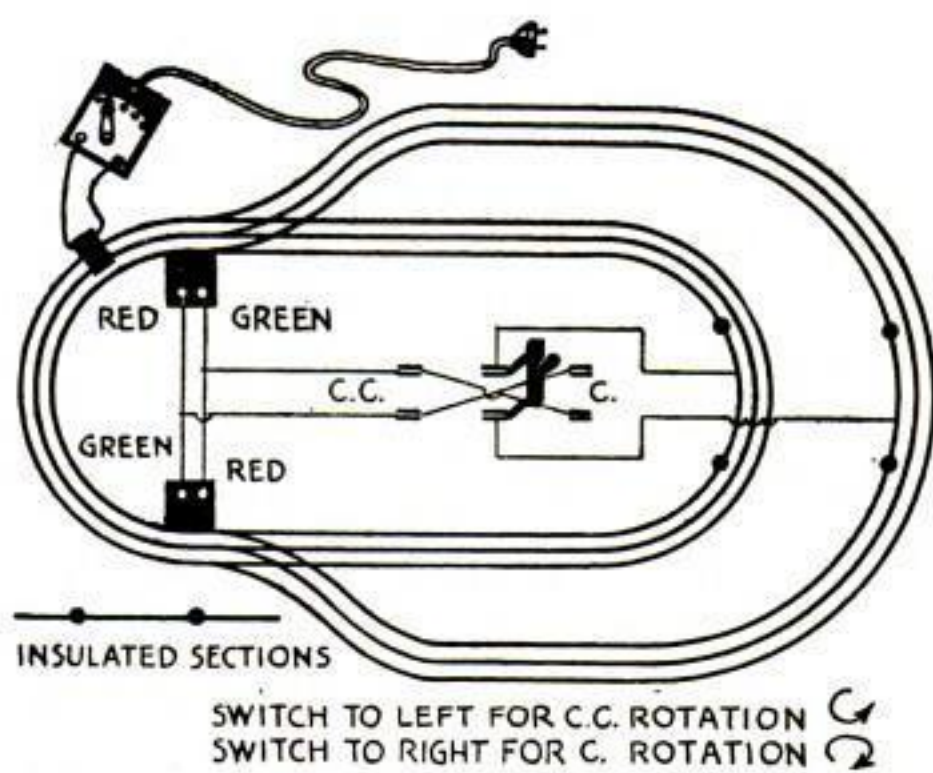
A simple spring switch for operating signals or almost any kind of electrical accessory

track lever. This is done by a rubber band hooked under the track lever. The tension of this band should be adjusted to sustain the weight of the track, but to yield to a slight additional pressure. Tension can be varied either by moving the nail over which the band is looped or by varying the number of strands in the band. The nail should be set a little to one side of the shaft so the band will not rub against it and prevent free motion.

The base and the sides of the box containing this simple mechanism may be made of cigar-box wood or tin with a removable tin cover. Nail stops are provided to prevent the arm from going too far up or down.

If desired, the arm may be made to show a

ROUTING MODEL TRAINS IN EITHER DIRECTION

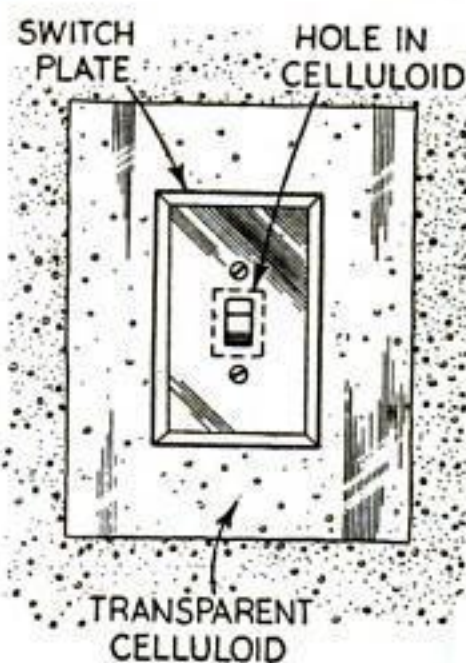


With this hook-up, the train automatically changes routes, clockwise or counterclockwise

A MODEL train may be made to change its route automatically and yet operate in either direction around the track by making use of the hook-up shown in the accompanying diagram. The arrangement is similar to that given in a previous article (P.S.M., Dec. '36, p. 101) except for the fact that I have made use of a double-pole, double-throw switch to enable the train to be run in either a clockwise direction, marked *c*, or counterclockwise, marked *cc*.—G. H. ASTON.

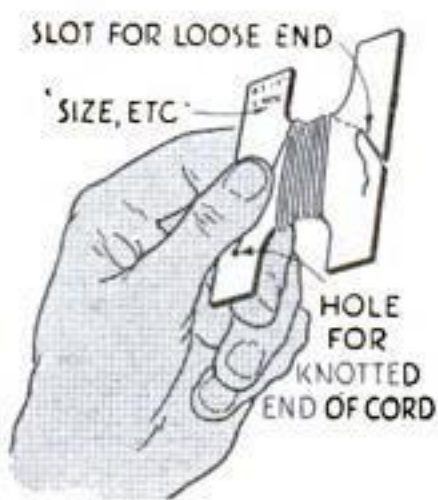
HOW TO PREVENT SMUDGE AROUND LIGHT SWITCH

A COMMON eyesore in many houses is the dirty smudge on the wall paper around the light switch. A sheet of transparent celluloid, cut slightly larger than the size of the average smudge and fastened beneath the switch plate, forever eliminates this nuisance, provided it is applied while the wall paper is still clean.



The hole in the celluloid sheet should be large enough to clear entirely the open section of the switch, thus avoiding any danger of fire from a chance spark. Punch two small holes for the switch-plate screws. Clear celluloid shows the wallpaper pattern and is almost invisible; if, however, the wall paper has already become soiled, opaque colored celluloid may be used to conceal the smudge. Soap and water, or merely a wet rag, will keep the surface clean.—LAWRENCE N. OLSEN.

CARDBOARD REEL KEEPS RIGGING IN ORDER

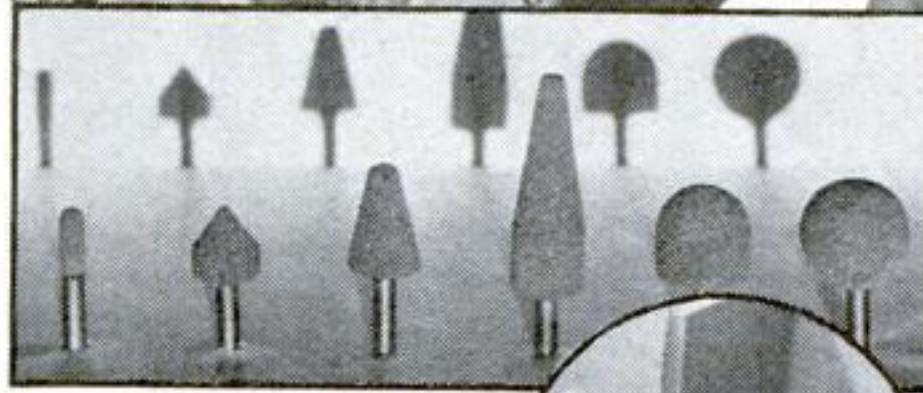
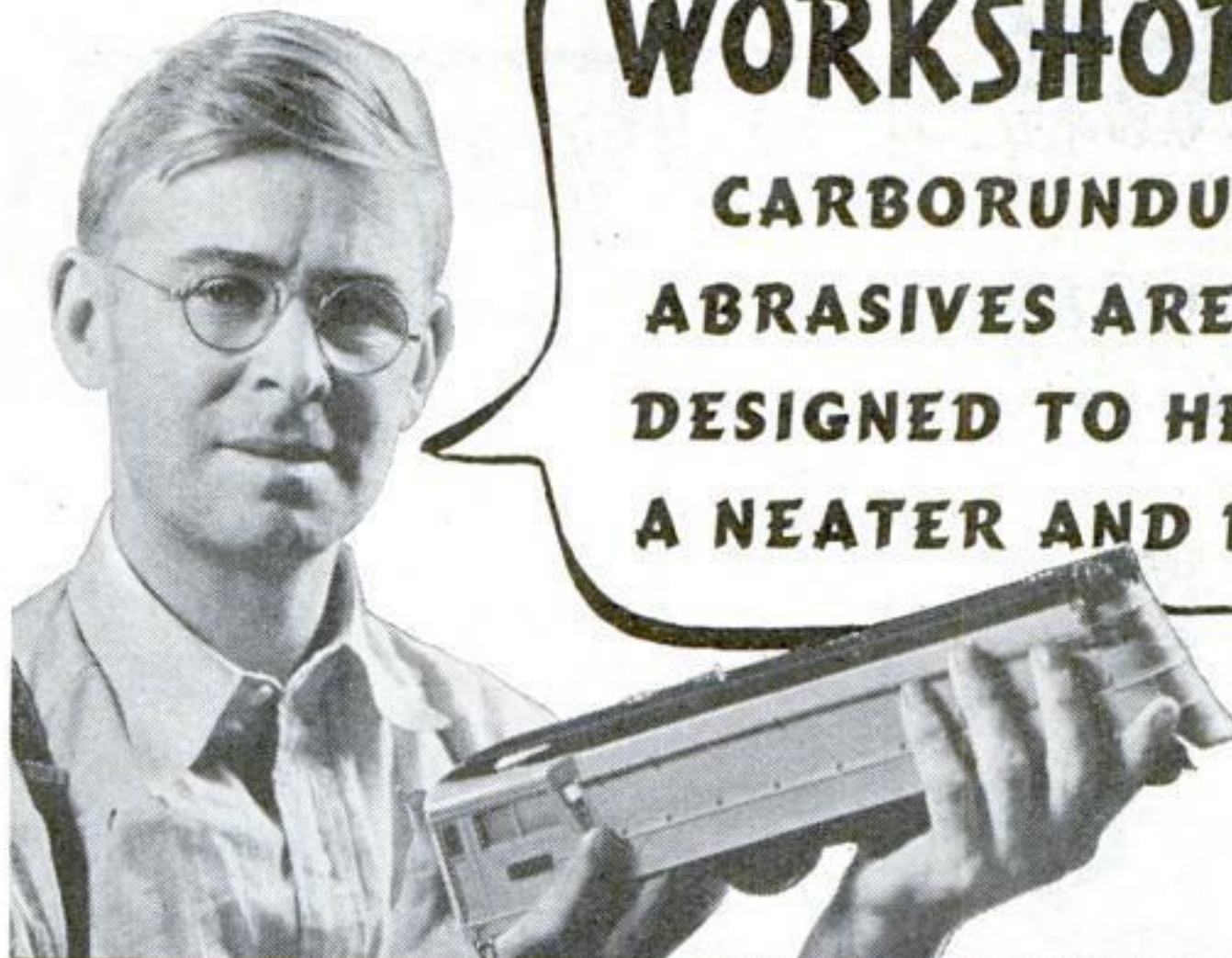


To keep loose rigging line intact while working on ship models, I cut a piece of cardboard 2 by 3 in. in the shape illustrated, and mark the size of the cord and other data in one corner. This prevents having to unravel tangled cord and also saves considerable time.—F. J. McAREE.

GRINDING wheels of the wet variety should never be allowed to stand partially immersed in water for protracted periods when not in use. Such treatment throws them out of balance. Furthermore, wheels that are not saturated evenly soon wear out of round.

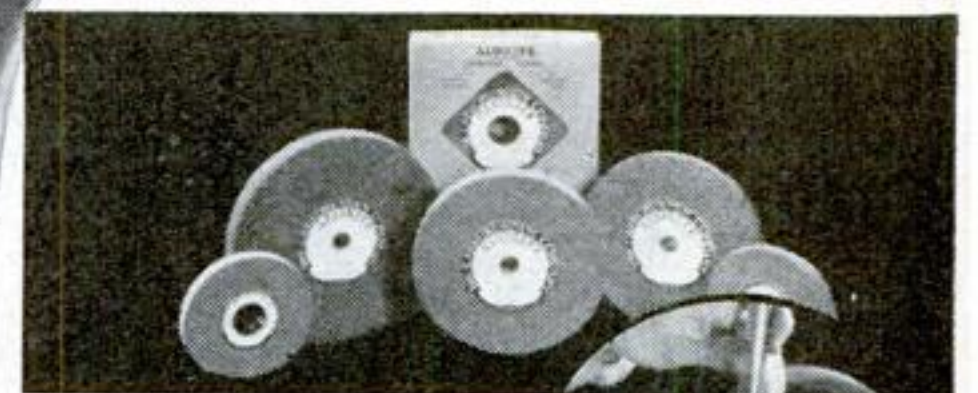
WORKSHOP FANS!

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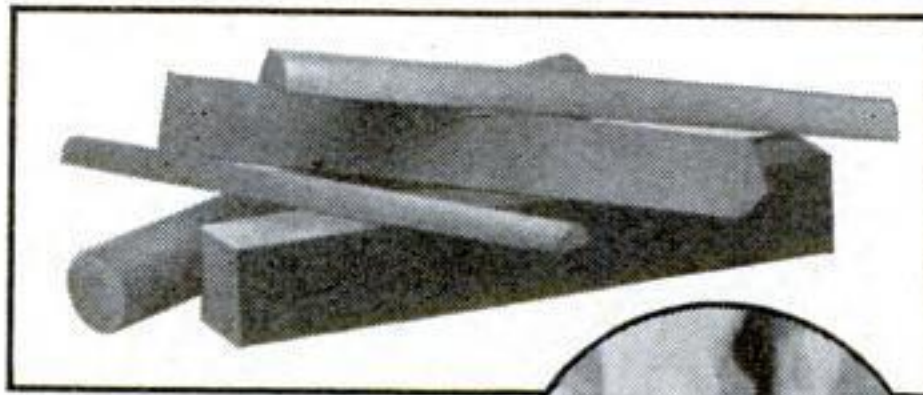
MOUNTED POINTS GET AT HARD-TO-REACH PLACES

Use these miniature grinding wheels in high speed portable grinders. At right: Removing end of wood screw with mounted point.



GRINDING WHEELS DO A FAST, CLEAN-CUT JOB

Every shop should have at least two wheels. One for general metal grinding—one for tool grinding. Right: Smoothing a welded joint.



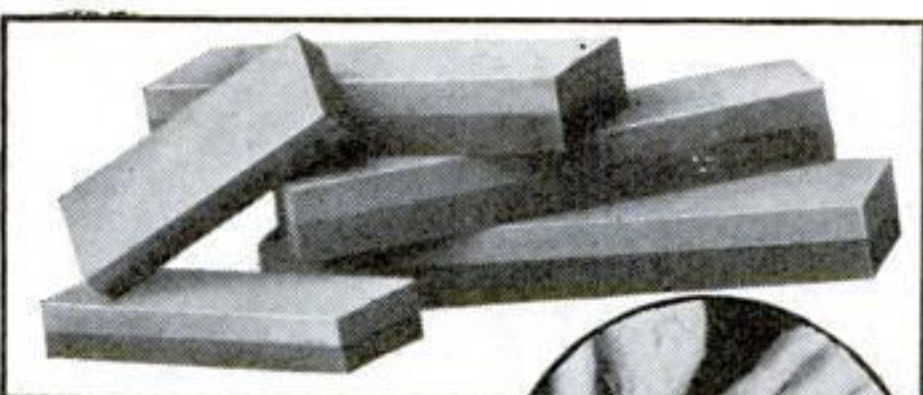
STICKS SMOOTH THE SMALL SHARP CORNERS

Do a neater job with special Carborundum Brand Silicon Carbide sticks. Right: Lapping hole in pulley with cylindrical stick.



SLEEVES AND DISCS MAKE SANDING JOBS EASY

Save yourself time and energy with a disc sander or sleeve. Right: Surface sanding small block with abrasive disc on drill-press spindle.



COMBINATION STONES KEEP TOOLS RAZOR-SHARP

A few strokes brings chisel, gouge, draw knife or plane to a keen cutting edge. Right: Sharpening chisel on Carborundum Brand Silicon Carbide stone.



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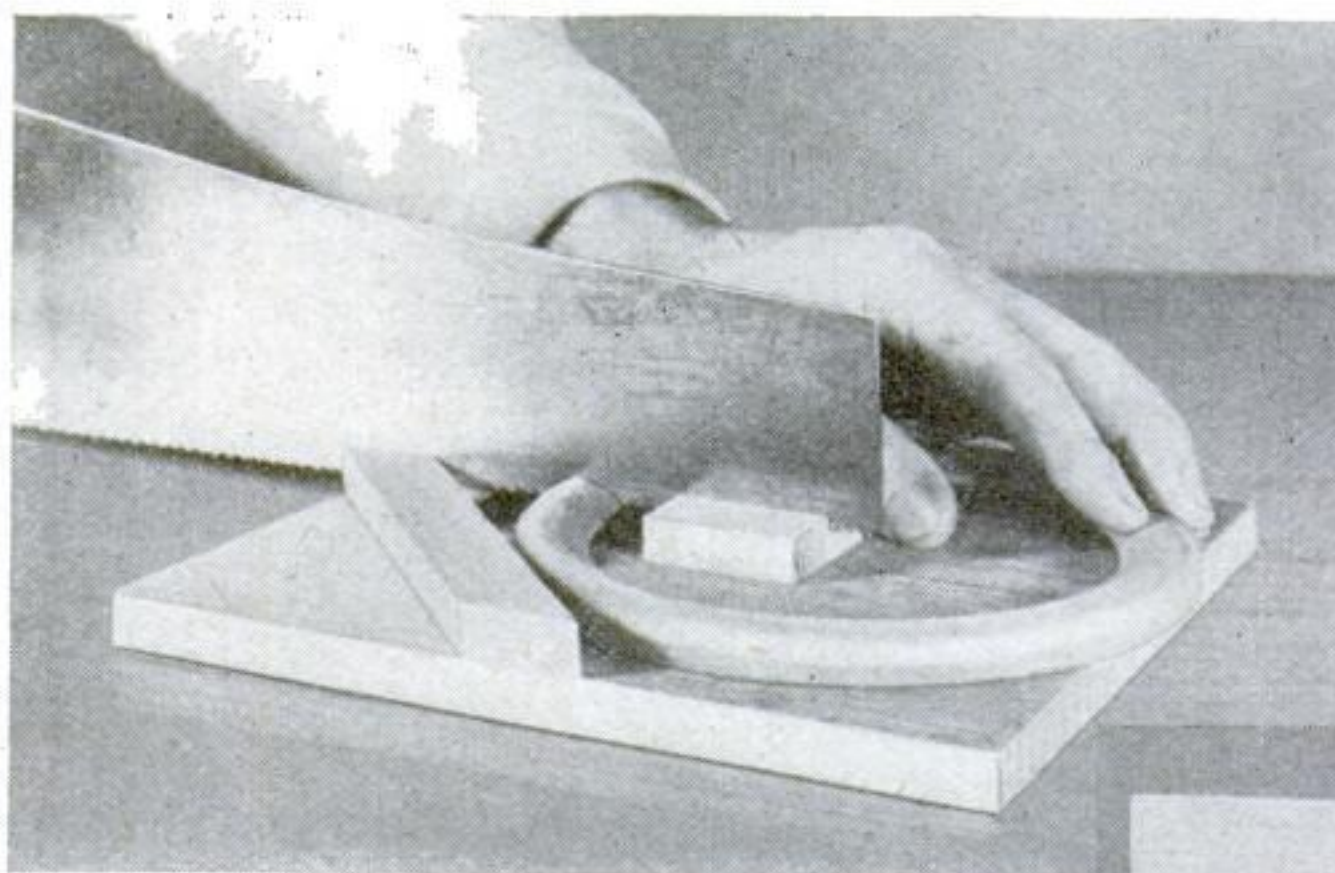
BLADES

**FIT GEM AND
EVER-READY RAZORS**

Using Your Lathe to Make Oval Picture Frames

By
**HOWARD
R.
HEYDORF**

Two rings are turned in the lathe, one larger than the other as shown below; these are then cut up by means of the cutting board to provide four pieces to form an oval



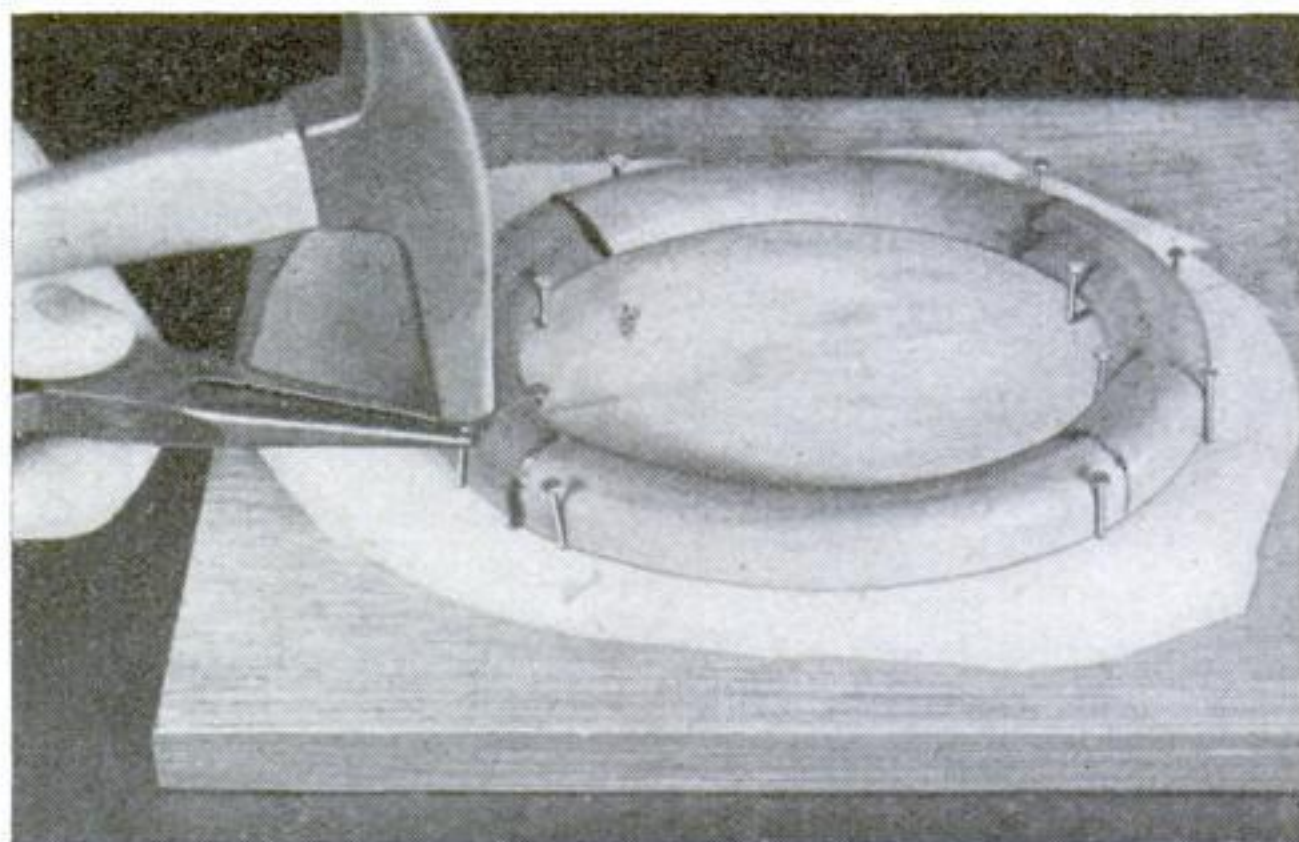
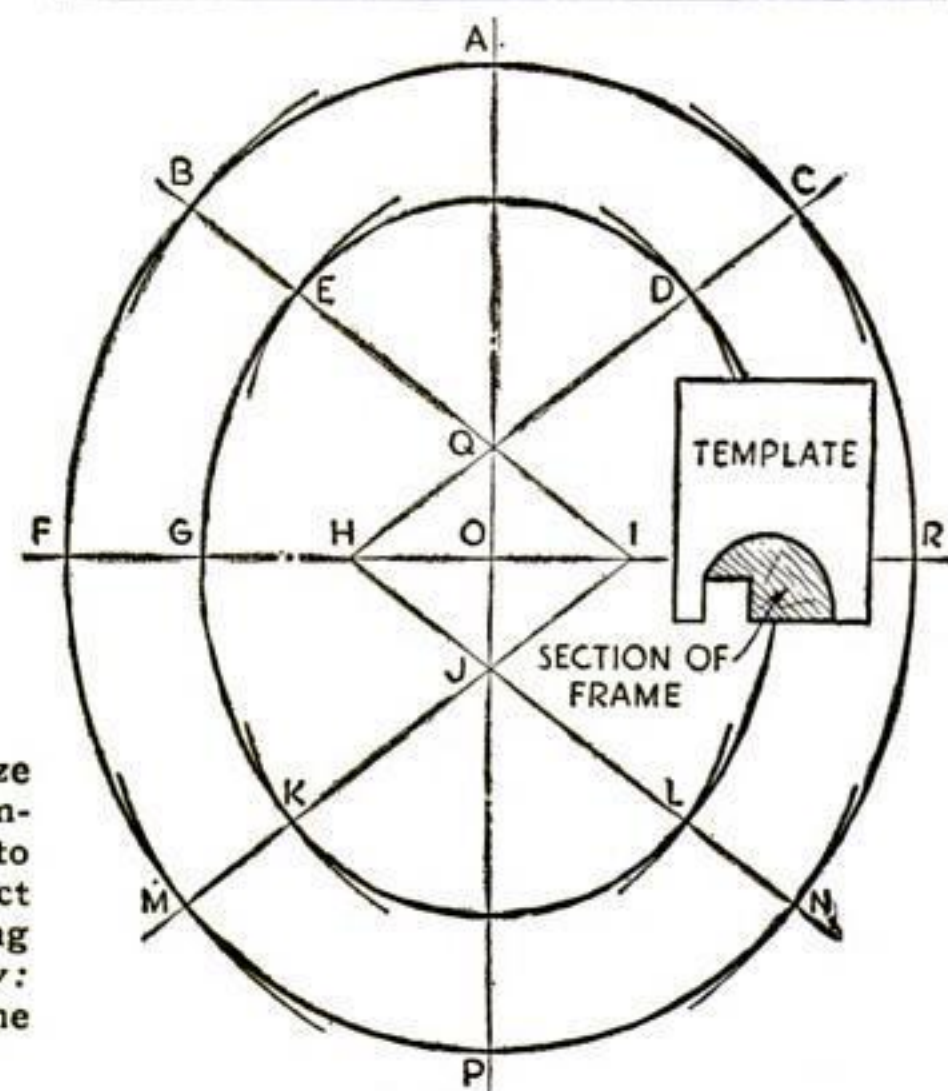
AMATEUR craftsmen often wish to construct small oval frames for pictures, mirrors, and various decorative purposes, but are usually puzzled as to how to proceed.

A diagram should first be drawn to determine the proper shape and size of the oval. AP is drawn at right angles to FR . Q and J are equidistant from the center O , as are H and I . The distance QO is five sixths the length of OI . I is the center of the arc BFM . The radius IF is four times the length of OI . The arc CRN with the center H is drawn with the same radius. Lines HC , HN , IM , and IB are drawn as shown through the centers H , Q , I , J . These are the cutting lines. Arc BAC is drawn with the center Q and the radius QC . Arc MPN is drawn with the same radius and with the center J . The inner oval is drawn in the same manner, using the same centers. By changing the proportions given, the form of the oval may be altered as desired. A section of the frame also should be drawn, and a template made of thin brass, although cardboard will serve.

Two rings of wood, one with an inner radius of IG and an outer radius of IF and the other with an inner radius of QD and an outer radius of QC are turned on the lathe. A wooden chuck is made, and the smaller ring is placed in it and turned to conform to the shape of the template. The ring is then reversed in the chuck, and the rabbet to take the glass is cut. The larger ring is turned in the same manner, care being taken to have the cross-sectional shape of the rings exactly alike.

A cutting board is needed to cut the rings accurately. A line for the saw is drawn, and two other lines are drawn at an angle of 45 deg. to the first line. Two strips of wood with their ends mitered at 45 deg. are nailed along these lines, allowing enough room for the saw to pass through. Two small blocks are fastened along the saw line to guide the saw. The rings are now marked from the diagram and cut with a back saw or a fine-tooth panel saw. The parts should be placed together and any inaccuracies corrected with a sanding disk. The frame is fastened together with waterproof glue and held till dry.

How the full-size diagram and template are made to find the correct size for turning the rings. Below: Gluing the frame



GUILD AIMS TO COVER MAP WITH CLUBS

(Continued from page 91)

It is estimated that fully seventy-five percent of the clubs participated in community work of various kinds last year.

All clubs also have the benefit of several services provided by the national headquarters of the Guild. In addition to issuing a monthly bulletin and many job sheets, the Guild through its new Program Service Bureau is making it easy for clubs to stage a number of interesting and instructive programs at their regular meetings.

The bureau has also made a survey of the leading manufacturers of home workshop supplies and equipment, and many have agreed to cooperate by lending the local clubs free moving picture films, giving demonstrations, or distributing informative pamphlets.

More than 100 home workshop experts throughout the country have volunteered to talk before clubs located near their homes.

ROLL CALL OF CLUBS

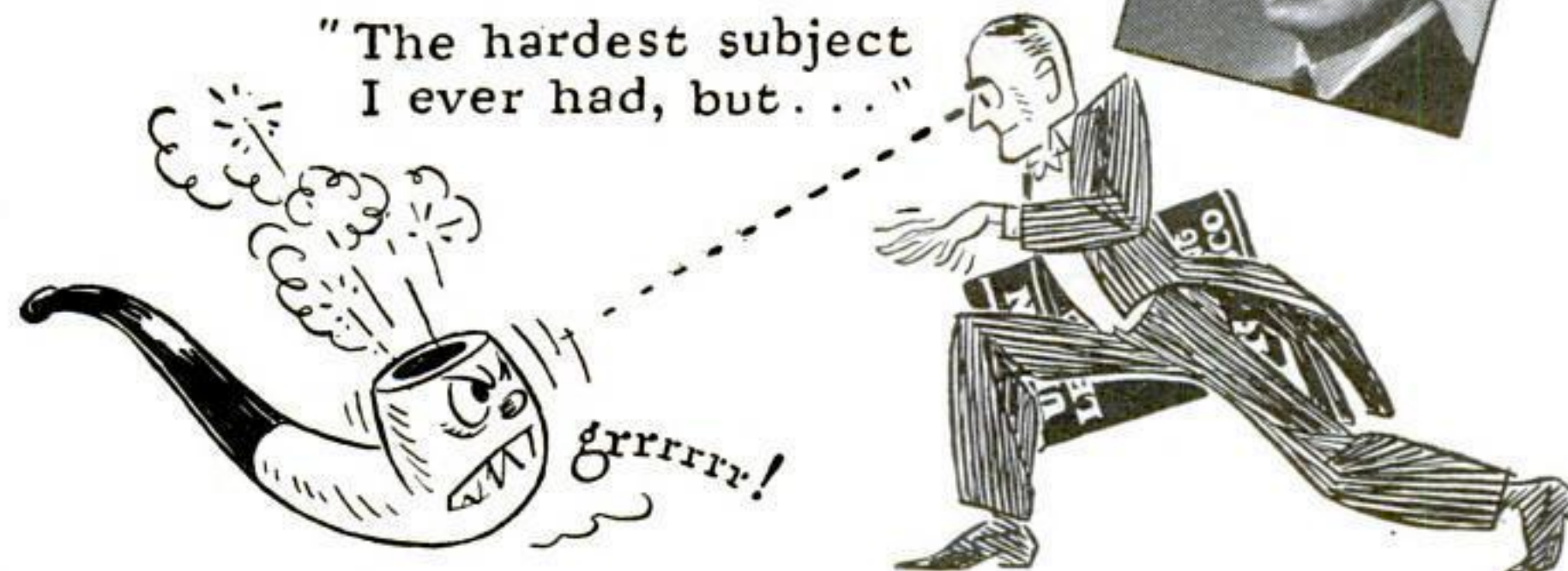
(Continued from page 91)

MICHIGAN	OKLAHOMA
Detroit	Bartlesville
Flint	Oklahoma City
Mount Clemens	Ponca City
Muskegon	OREGON
Saginaw	Eugene
MINNESOTA	Portland
Dawson	Roseburg
Detroit Lakes	The Dalles
Minneapolis	PENNSYLVANIA
Red Wing	Chester (2)
MISSISSIPPI	Easton
Brookhaven	Erie
Corinth	Fair Oaks
Gautier	Kutztown
MISSOURI	Lester
Independence	Norristown
Kansas City	Philadelphia (3)
Mansfield	Pittsburgh (3)
Rolla	Scranton
St. Louis (3)	Sharon
MONTANA	Sharpsburg
Billings	Stroudsburg
Great Falls	RHODE ISLAND
Miles City	Pawtucket
Paradise	TENNESSEE
NEBRASKA	Chattanooga
Alliance	Memphis
Lincoln	TEXAS
South Sioux City	Kingsville
NEW HAMPSHIRE	Lamesa
Dover	UTAH
Manchester	Laketown
NEW JERSEY	Provo
Collingswood	VIRGINIA
Elizabeth	Beach
Hoboken	Norfolk
Kenilworth	Richmond
Maywood	West Point
Morristown	WASHINGTON
Newark	Coulee Dam
New Egypt	Seattle
Paterson	Spokane (2)
Wood-Ridge	Tacoma
NEW MEXICO	Walla Walla
Roswell	Yakima
NEW YORK	WEST VIRGINIA
Brooklyn (6)	Beckley
Buffalo (2)	Bluefield
Cohoes	Fairmont
Cooperstown	Fayetteville
Dunkirk	Missouri Branch (2)
Elmira	WISCONSIN
Freeport, L.I.	Cudahy
Hornell (2)	Fond du Lac
LeRoy	Kenosha
Maspeth, L.I.	Madison
Meridian	Menomonee
Mount Vernon	Milwaukee
Newburgh	Racine
New York (7)	Waupaca
Niagara Falls	WYOMING
Patchogue, L.I.	Cheyenne
Peekskill	CANADA
Syracuse	Coleman, Alberta
Utica	Edmundston, N. B.
NORTH CAROLINA	Frontier, Sask.
Charlotte	Hamilton, Ont.
NORTH DAKOTA	Montreal, P. Q. (2)
Fargo	Moose Jaw, Sask.
OHIO	Ninette, Man.
Cincinnati (2)	Ottawa, Ont. (2)
Cleveland	Penticton, B. C.
Findlay	Trois Rivières, P. Q.
Maumee	Vancouver, B. C. (2)
Newark	Victoria, B. C.
Toledo	PHILIPPINES
Zanesville	Manila

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ment." Specially selected *ripe leaves* of Kentucky Burley, richly flavored by Nature, are expertly cured and *aged-in-wood* to make Union Leader. This loving care holds all the flavor and fragrance, but banishes bite and burn. (Try Union Leader for a new cigarette flavor, too!)

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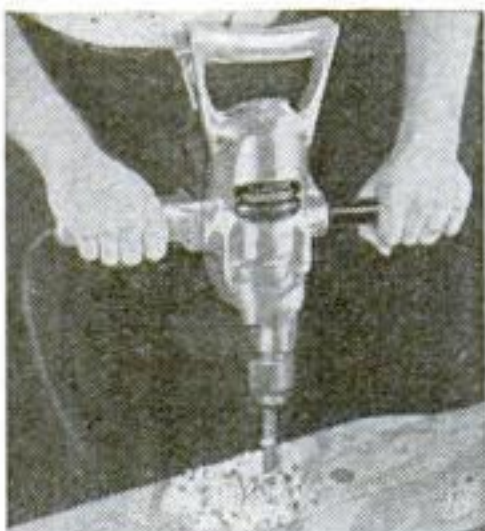


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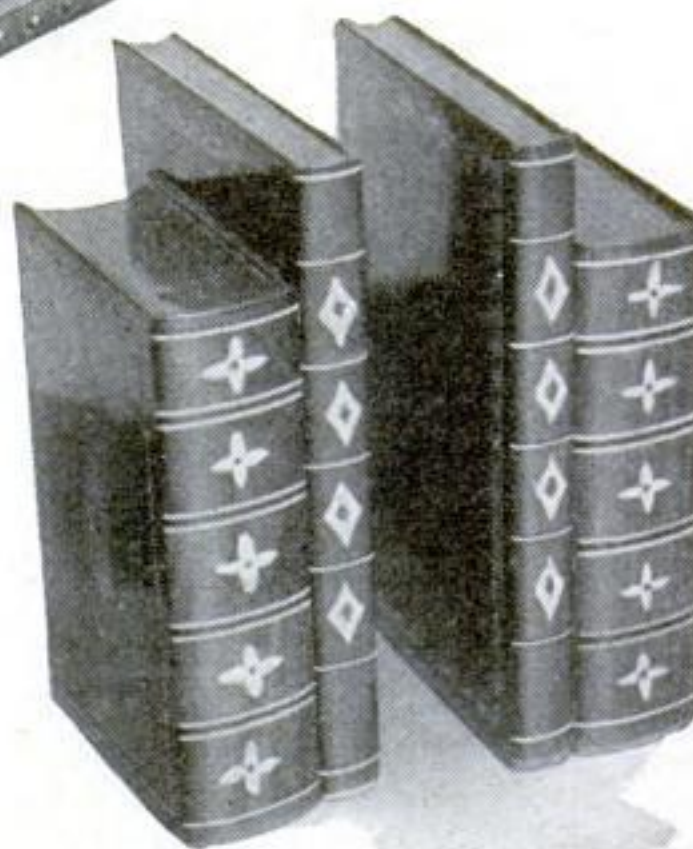
Address.....

City.....State.....

Guild Clubs Expand Activities AS MEMBERSHIP INCREASES



Miniature treasure chest by C. T. Phillips, Oakland, Calif., and a pair of inlaid walnut and cherry book ends by George A. Simonds, Washington, D. C.



EXPANDED activities—the result of increased membership—are planned by Guild clubs for the coming months. Some groups have scheduled special classes in photography, woodworking, and similar subjects, while others are getting ready for larger and better exhibitions this year. A number of clubs have started to build or enlarge their own workshops. The latest reports from club secretaries follow:

Coulee Dam (Wash.) Homeworkshop Club. A recent meeting was held at the home of E. Robert Hagan, who has just fitted up the basement to house his home workshop. He exhibited a new 6-in. jointer and a new photographic enlarger, constructed and partially designed by himself. The members discussed the Guild project contest and the use of wood-turning lathe tools.

"Y" Craftsman's Guild, Victoria, B. C., Canada. Under a new plan of expansion, the group combined with the Camera Club. Each has its own secretary, but the other officers govern both clubs. The members now have available a medium-sized auditorium, a photographic laboratory, and a workshop. The club, which has twenty-four members, plans to build a cabin on the shores of Glintz Lake under the supervision of Alec Craigmyle, John Bong, and Maurice Pickering. Camp furniture will be constructed in the workshop under the direction of Arthur R. Cann. A large number of table games have been built for the Y. M. C. A., and a drying cabinet for the laboratory. The officers are Harvey Dobson, president; Wallace Cameron, vice president; Abner Garland, treasurer; Arthur R. Cann, secretary; Jack Kemp, librarian.

Lambert Boat and Mariners Ass'n, Chicago, Ill. More than forty persons attended "Neighbors' Night" held in the club's field house. Moving pictures lent by the local safety council were shown. An old-fashioned Dutch lunch was served by the women, and the men discussed shop problems. Music was furnished by the junior division. A large amount of clothes, food, and toys were donated to be given away at Christmas. . . . The Junior Association made many Christmas presents on the scroll saw. Joseph S. Lambert, son of Capt. R. D. Lambert, entertained at several meetings with stories of travels.

Cartier Homeworkshop Club, Montreal, P. Q., Canada. Much interest is being shown in the monthly bulletin published by the secretary, Paul Denis. Jean Tremblay was the editor of a recent edition, which contained

articles on chemistry, model railroading, wood-working, and working in cardboard. Maurice Latreille is constructing a railway car made out of wood except for the electric motor.

Ocala (Fla.) Homeworkshop Club. A. F. Eastman was elected president at the annual meeting held at his home. J. S. Tuttle is vice president; Pinkney Clements, secretary; Talmadge Campbell, treasurer. On the board of governors are W. D. Harrison, Levis Smith, and Cecil Bryant. Mr. Eastman exhibited some hand-constructed machines and various articles he had made. . . . A chop suey dinner was held at his home in January.

Edmundston (N.B., Canada) Hobbyists. The local Boy Scouts distributed the toys made by the club for needy children at Christmas. A wood sculpture of a team of oxen drawing a plow and guided by an old man was named the best project of the month. Made by A. Nadeau in 163 hours, it is accurate to the smallest details.

Queen City Craftsman Club, Cincinnati, O. The local public recreation commission has presented the club with a workshop meeting place and a universal wood-working machine.

Bartlesville (Okla.) Homeworkshop Club. C. C. Campbell displayed many types of wood, veneers, table tops, turning squares, and plywoods and gave a talk about them. A demonstration on upholstering was given at another meeting. The club is the largest in the state and one of the largest in the Guild, having a membership of nearly 150.

Beach (Va.) Workshop Club. Work on the construction of fifteen Cape Cod chairs was started recently. Plans are being formulated to erect the club's own workshop, present activities being held twice a week in a Park Service workshop. Willard D. Kibler is president; Obie W. Bryant, vice president, and Earnest Comer, secretary. Two experienced Park Service foremen act as supervisors.

Capital Homecraft Club, Washington, D. C. At a recent meeting George A. Simonds reviewed an article about the search around the world for beautiful veneer woods and described the uses of woods for furniture.

Tri-City Homeworkshop Club, LaSalle, Peru, Oglesby, Ill. H. B. Rothwell, local man-

Keep a Photo Record of Your Club



WHEN your club makes or does something of unusual interest, have some photographs taken and keep them in an album as part of the club records. Send unmounted prints of the

best of them to the National Homeworkshop Guild, 347 Fourth Avenue, New York. As many as possible will be published in this magazine.

ual training teacher, demonstrated upholstering at the home of Joseph C. Rucinski. Daniel Jones spoke on linoleum carving at the home of Walter Menning.

Madison (Wisc.) Homeworkshop Club. A talk on abrasives was given at a recent meeting. Toys were made for the Empty Stocking Club, a city-wide Christmas project. R. V. Waters has been elected president for this year; H. E. True, vice president; J. J. Teska, secretary-treasurer; Dr. J. B. Olson, Dr. H. S. Bostock, and F. F. France, board of governors.

Utica (N.Y.) Homeworkshop Club. Moving pictures are being shown once a month. A club library has been started. Toys were mended for distribution among poor children at Christmas, and at present the members are making table-tennis tables and other games for the Community Club of Utica.

Buffalo (N.Y.) Homeworkshop Club. Organized recently, this club has established its own workshop and holds four meetings a month. Plans are being made to move into larger headquarters in the spring.

Erie (Pa.) Homeworkshop Guild. Officers for the new term are A. B. Corziliou, president; B. J. Ginader, vice president; R. A. George, secretary; D. Verdane, treasurer. On the board of governors are W. H. Brumfield, W. E. Ostermaier, O. E. Hengstler, and E. Eaton. A demonstration on the uses and applications of power tools was given recently.

New Bedford (Mass.) Woodcraft Club. An illustrated lecture on the San Diego Fair and Greenville Village was shown. The members enjoyed a chow mein supper in the clubroom, the first of a series to be held during the next six months. O. C. Johnson was elected publicity chairman. Spindle shapers designed by one of the members were constructed.

Hyattsville (Md.) Woodworking Club. The first annual meeting was held in the manual training room of Hyattsville High School. William H. Koppialky was elected president; Stanleigh E. Jenkins, vice president; William E. Hutchinson, secretary-treasurer; Lester A. Pigott, librarian. The board of governors consists of Earle Dorrelle, Albert L. Frazier, Robert G. Porter, and the officers.

Frontier (Sask., Canada) Homeworkshop Club. The use of a room 20 by 24 ft. located over the town garage for a clubroom and workshop has been donated by the president. A drive for new members is being conducted at present.

Brookhaven Homeworkshop Club, Chester, Pa. A junior league has been organized with Fred Taylor as president. The juniors recently held an exhibition of bird houses. The club is undertaking to sponsor a Boy Scout troop.

North Shore Craftsman Club, Waukegan, Ill. The members repaired Christmas toys for poor children of the town. The clubroom, located in a garage, has been modernized, the club logging its own black walnut.

Seattle (Wash.) Homeworkshop Club. Reorganized recently, this club now has a membership of more than 50 members and plans an active season. The officers are E. A. Horn, president; Dr. T. O. Anders, vice president; J. C. Kiger, secretary-treasurer. Meetings are held in the New Richmond Hotel, and a completely equipped workshop will be available for the members soon.

Fall River (Mass.) Homecraft Club. Albert Boutin demonstrated the uses of the circular saw at his workshop. A dinner is planned for the club's first anniversary.

St. James Workshop Club, Montreal, P.Q., Canada. Broken toys were mended to be given to needy children at Christmas. Several members have been working on a lighthouse model for the club's train layout.

Homecraft and Modelmakers' Guild, Richmond, Va. Officers for the new term are Gordon Hammond, president; M. T. Turner, vice president; F. W. Harrison, secretary-treasurer; M. E. Ryder, (Continued on page 116)

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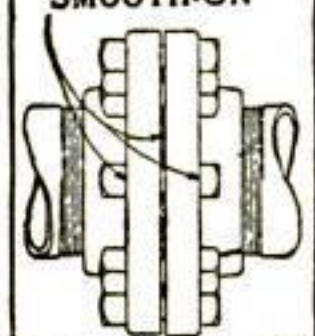
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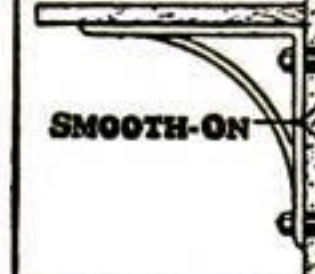
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GUILD CLUBS EXPAND THEIR ACTIVITIES

(Continued from page 115)

librarian. Members of the board of governors are Dr. C. L. Albright, F. E. White, Tuck Fuqua, L. H. Perrot, and R. H. Athearn. Toys for the needy were constructed before Christmas.

Science Homeworkshop Club, Brooklyn, N. Y. The club is studying light and lenses as part of its photographic work under the supervision of the president, Morris Horowitz. Hyman Cohen is vice president and Abraham I. Eisenstadt, secretary-treasurer.

Ship Craft and Model Engineering Guild, Cincinnati, O. At the annual meeting the following were elected: Elmer Schilling, president; Earl Dodds, vice president in charge of split-bamboo fishing rod construction; Charles Tribble, vice president in charge of model gas plane construction; Victor Freidenheim, secretary-treasurer; William Richards, general director. It is the intention of the club to cover as much of the model making and hobby field as possible this year.

Galesburg (Ill.) Homeworkshop Club. Officers elected at the annual meeting were H. K. Childers, president; John Lohmer, vice president; B. M. Kidder, secretary-treasurer; H. R. Line, librarian.

Lakeside Homeworkshop Club, Muskegon, Mich. F. E. Haines spoke about lumber at a recent meeting. Floyd L. Lewis, secretary, discussed "Drawing and Blueprint Reading" at the following session. Talks on wood turning and wood finishing are scheduled for the near future.

Oriole Homeworkshop Club, Baltimore, Md. Ideas for Christmas gardens and the care of electrical equipment were discussed previous to the holidays. Exhibitions are being held in local hardware windows as part of a membership drive.

Handicraft Club of Milwaukee, Wisc. A lecture on the kinds of wood, their structure, and use in furniture manufacturing was given by Clifford Taylor. Officers are George B. Smith, president; Thomas O'Neill, vice president; Herbert Winters, secretary and treasurer.

START A WORKSHOP CLUB IN YOUR NEIGHBORHOOD

IF YOU would like to start a home workshop club in your neighborhood, send the attached coupon or write a letter to the National Homeworkshop Guild. Complete information will be mailed you immediately. Be sure to inclose a stamped, self-addressed envelope with your request.

There is no charge for membership in the Guild, and all its services are free. It has nothing to sell and is entirely noncommercial. The Guild will recognize as a club any group of five or more persons who are over sixteen years of age, who meet monthly or oftener, and agree to abide by the simple rules of the organization. The longer you delay in starting a club, the more benefits you are missing.

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Flawless Balloon Ceiling Conceals Badly Cracked Plaster

and a 12-in. piece of 1 by 2-in. wood was nailed crosswise on one end. The upper edge of the 1 by 2-in. piece was beveled at a 45-deg. angle until but a $\frac{3}{8}$ -in. edge remained on the outer side. Into this narrow edge 1-in. No. 18 brads were driven $\frac{1}{2}$ in. apart, and about $\frac{1}{2}$ in. of their length was left above the wood. Next, the heads were cut off with pliers, leaving a row of sharp points.

By holding this stretcher as shown in one of the photographs and putting the nails into a portion of the cloth where the holes would not show after tacking, very great pressure could be exerted—far more than was possible with the hands alone. By nailing at the right-hand end of the stretcher first and then working back to the last tacks driven, the cloth may be kept firm and even like a drumhead.

As soon as the entire job is tacked, inspect the work foot by foot. Wherever a pucker occurs, remove one or more tacks with a screw driver, using great care to avoid tearing the cloth. Stretch such portions with the hands while your helper tacks in between.

Next use a pair of sharp shears—not a knife, as a slip of the latter may easily ruin the job—to cut off the excess cloth. Trim the cloth exactly even with the face of the wall to insure that sufficient remains so the tacks will hold at all times. Do not attempt to rip the cloth rather than cut it with the scissors.

Tack the ceiling fixture area or register opening, placing the tacks so that they will be covered by the fixture canopy or ceiling register. Do not cut the cloth from the fixture opening at this stage, but wait until the sizing and calcimining are complete.

Before decorating the ceiling cloth, either prepared sizing or glue may be used. For the

(Continued from page 89)

latter, soak a pound of sizing glue in an equal amount of cold water the night before starting the job; and the next morning cover with sufficient boiling hot water to make up a gallon of size. Stir until all glue is melted, and apply freely with either a 6-in. wall brush or a larger calcimine brush. The size will take hold better if used hot. It should be reheated if necessary. A gallon will do for about 250 sq. ft. of cloth. Have the floor well covered with building paper to prevent glue spots, which are rather hard to remove from varnish. The method of removing an accidental glue spot is to wet it with cold water and then wipe it off with a hot cloth.

Let the ceiling dry overnight, during which time a shrinking movement takes place and most of the slack disappears.

While the cloth is drying, apply the first coat of eggshell enamel, of the trim color used in the room, to the sections of cove molding

so that after the ceiling is calcimined the next day the molding can immediately be put in place while the calcimine is drying.

The calcimine or cold-water paint is generally used at the rate of 6 pints of cold water to 5 lb. of calcimine. For balloon ceilings, however, this must be made much thinner, generally 11 pints of water to 5 lb. Add the dry powder to the cold water while stirring vigorously, and at the end strain through cheesecloth into another pail.

When applying the cold-water paint, work in areas of from 12 to 18 in. square, leaving the margins rough or uneven. If possible, two men should do the work so that one completed area across the room has no chance to become even partly dried before the second man starts across on the adjacent area.

Brushes should be dipped only an inch into the pail, slapped against the inside face of the pail, and then immediately applied to a small area of the ceiling.

As soon as the entire ceiling is finished, the cove molding should be square cut and nailed to two sides of the room. The two remaining moldings should be very carefully measured for exact length, mitered, and then sawed along the mitered line with a coping saw to make an exact fit before they are nailed into place. Due to the fact that the ceiling is wet, great care must be exercised to prevent spotting it with the fingers, but if such an accident does occur, wipe the spot with a wet sponge and retouch carefully with thinned calcimine and a small clean brush.

In two or three years, when the ceiling begins to show traces of discoloration, all that is necessary will be to wash it clean and leave for two years more. Then it must be washed and recoated with half-strength calcimine.

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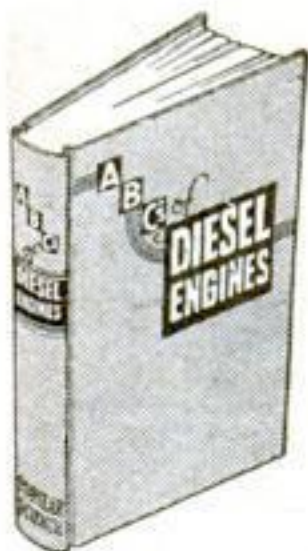
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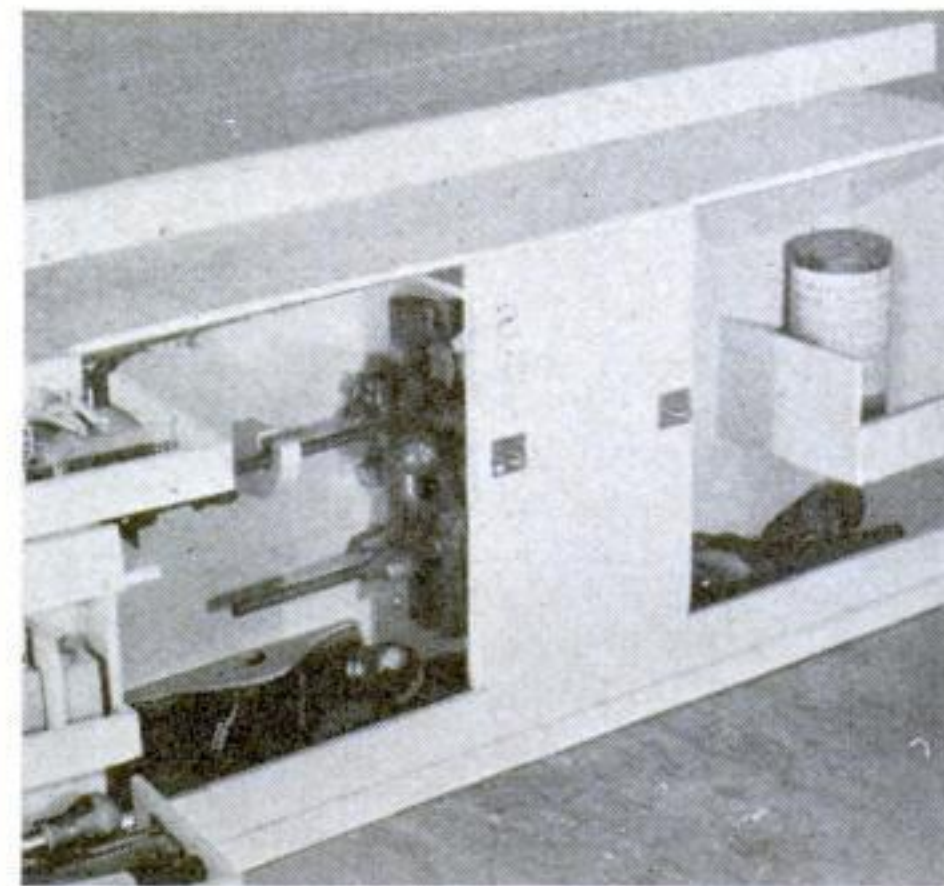
CARPENTER'S BOXES

(Continued from page 93)

glued and nailed to each other through the separating shims, anchor them solidly. Nail the stiffening bar at the ends and to the outer supports.

To prevent the saws from falling out when the lid is closed, make the notched lock shown. This is arranged so that the upper front notch meshes with a notch in the bar, while the lower end is held by a curved cleat. Snapped around against the spring of the saw blades, as in the illustrations, it holds the saws safely; yet it can be turned sidewise and removed with ease, entirely out of the way of the saws.

The photographs show the general arrangement of the tools, and the drawings give a variety of suggestions as to hooks and turn buttons to hold them. Use your own ingenuity in adapting the ideas to the tools you wish to carry. The level, carried under the top by



The interior of the box for finishing tools also has space for small hardware and supplies

two end supports, is prevented from jogging out when the box is closed by lid cleats that project and touch the level edge.

The carrying lugs are attached with flathead machine screws with the nuts and washers inside. Project them in front enough to center the carrying handle about over the box center.

The box for finishing tools has two doors, each carrying trays for displaying bits and other slender tools. Any desired arrangement of trays may be used, either as in the photograph or as suggested in the drawings. Note the angles of the tray ends—so made to clear the stops when the door is being opened. As rabbeted hanging stiles are used, filling out the front corners of the box, the tray bottoms are notched to clear them. Use brads driven into the bottoms to separate the tools.

Put a stiffening partition near the center of the box to brace the fixed front. Glue and brad projecting plywood strips to the edges of this fixed center front to act as door stops. It will be seen from the photographs that I carry a so-called "forty-five" combination plane in the left compartment against the partition, while a sawhorse vise occupies the space to the left of it. Above, but low enough to clear the tray, is a drawing knife supported on a large turn button. A back saw and a carriage rabbet plane lie on the bottom. I carry a smoothing plane on a shelf beneath the upper tray on the door at the right, while below is space for a router.

There is considerable space left over in this arrangement, but this is an advantage. There is room for a new tool or two, and shelves for extra supplies are added. There are many times on the job where a little cold-water putty, plaster of Paris, or a private assortment of brads, screws, and corrugated fasteners come in handy, and indeed may be the means of saving a man's job in these days when speed is the watchword.

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INSTALLING NEW TYPE OF KITCHEN LIGHT

(Continued from page 90)

gas pipe with an insulating joint serves as the fixture hanger.

The fixture bar supplied with the new unit is secured to the box by using a $\frac{3}{8}$ -in. lock nut on the box stud, as shown. If there is a gas pipe at the outlet, the insulating joint is removed and a gas cap, well filled with white lead or thick paint, is used instead of the lock nut. The fixture bar is first placed on the end of the pipe so it will be back of the cap.

THE porcelain ceiling piece or holder is now ready to be installed. The ends of the wires that are attached to the socket of the holder should be cleaned with the knife for a distance of about an inch, until the copper strands are bright and clean. The white or tracer-marked wire is twisted on the outlet wire that has a white covering, and the black fixture wire goes on the black outlet wire. Turn the ends of the joint over like a loop after twisting the wires tightly, so the sharp wires will not come through the tape.

The joints are then soldered. Soldering paste or flux is first applied, and solder is flowed on by means of an alcohol blowtorch or a soldering iron. Some paper laid in the top of the fixture will prevent excess solder and flux from dropping on it or the wires.

The next step is to tape the joints. To many this might mean simply wrapping some friction tape on them. On the contrary, the taping of joints cannot be too carefully done. The first application is that of rubber splicing compound, sold in rolls like friction tape. The cloth covering is first removed from a piece of compound 2 or 3 in. long, and the rubber stretched a bit. The piece is then tightly wrapped on the pigtail joint, as it is called by electricians. Take care to turn over the ends of the wrapping so the joint will be protected at that point. A piece of friction tape 6 or 8 in. long is now pulled off a roll, and this is wrapped on over the rubber compound. Turn over the ends as before to give maximum protection. There is little chance of such joints' causing trouble when they are folded up tightly and pushed into the rather small space in the top of the holder.

IF ANY of the plastering is broken around the outlet, it should be patched with patching plaster or plaster of Paris. The box should be tightly plastered in with no opening anywhere around its circumference. A small trowel will be found most convenient for this work. Take care not to extend the repair work if possible, beyond the distance covered by the new fixture.

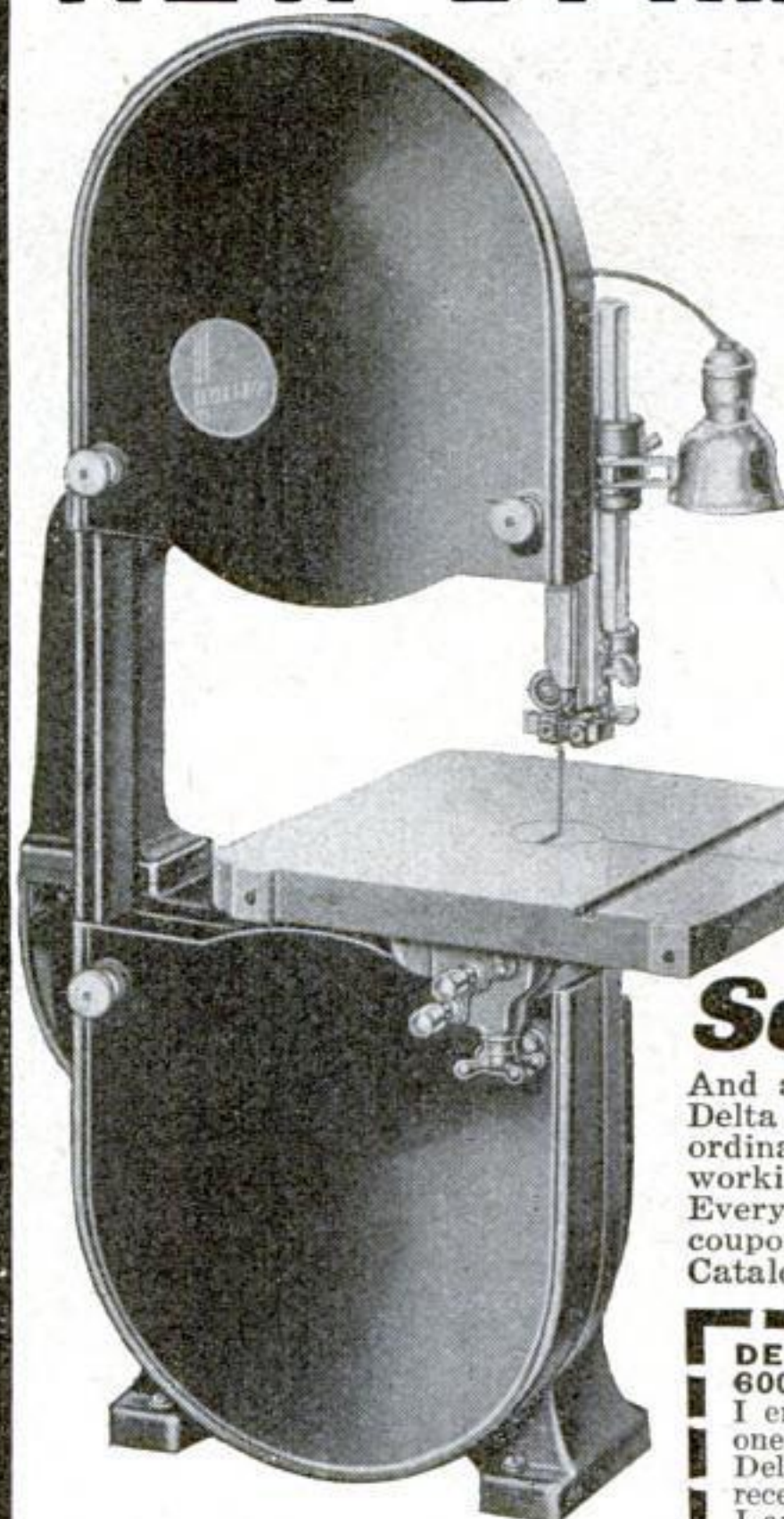
With this work completed, the wires and joints are carefully placed in a sort of circular form and pushed up to the outlet box. The holder is secured to the ceiling with the two 8-32 machine screws supplied with it. These enter tapped holes in the ends of the fixture bar. Use a long, rather slim screw driver to tighten the screws gradually, first taking up on one and then on the other, until the fixture is clamped against the ceiling.

The globe is fastened to the holder by three thumb screws in the usual way. If there is a wall switch for the room or if you are willing to wire one in, which is highly recommended, the pull cord may be eliminated.

PRINTING WEAK PHOTO FILMS

To MAKE good prints from weak photographic negatives, give a slightly longer exposure and develop as long as possible. After fixing and washing the prints, soak them in the following solution until the high lights become blue: Potassium iodide, 160 grains; iodine crystals, 16 grains; water, 4 oz. Remove the blue cast by replacing the prints in the fixing bath.—K. M.

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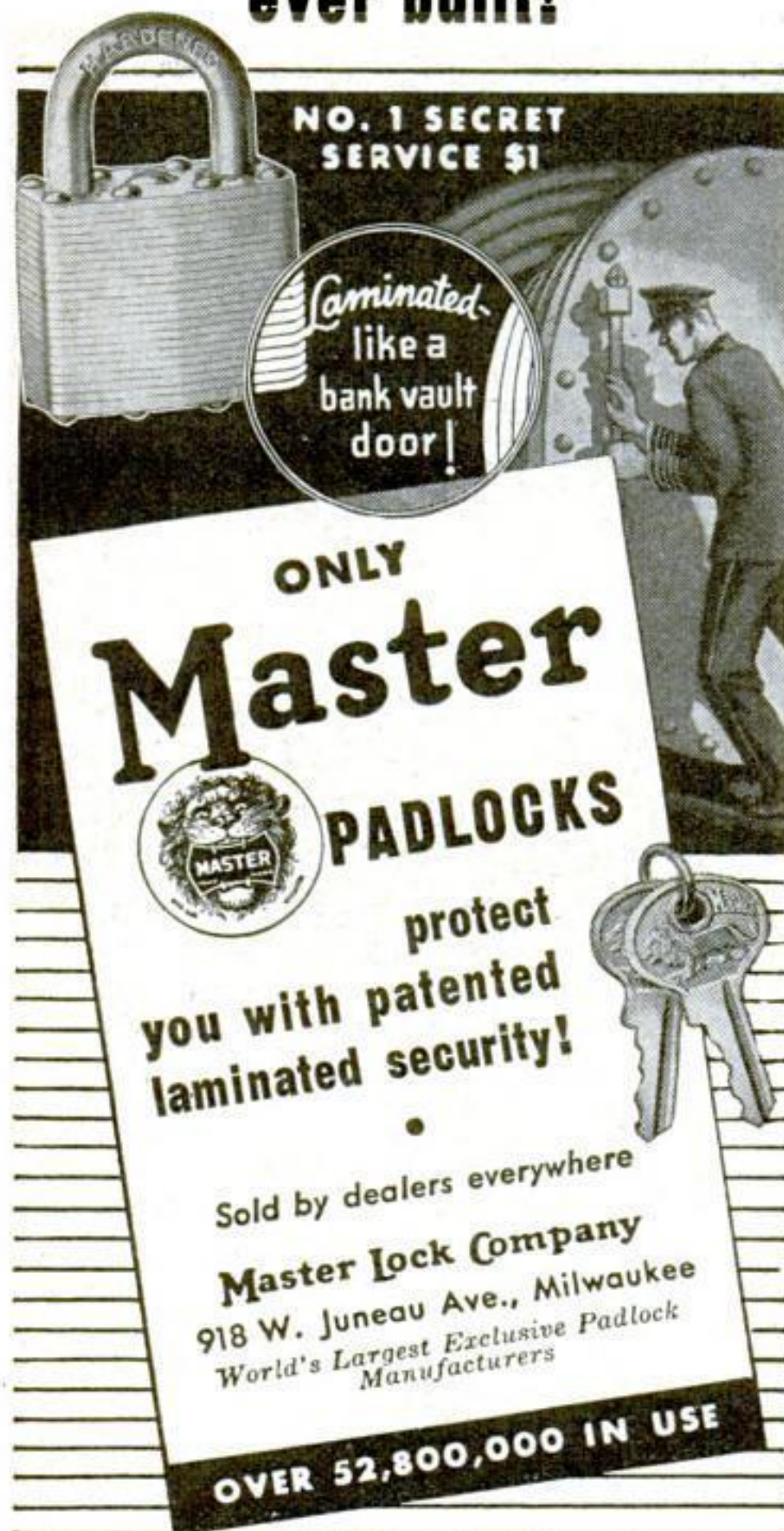
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EFFICIENCY in milling depends a great deal on the arbor. If it's sprung .003 in. and worn another .002 in., both machine and cutter are up against it.

Before driving in taper pins, always oil them to prevent them from becoming rusted in place.

Save discarded screw-slotting cutters and use them in gangs for spacers, or to fill in bolts for odd strapping jobs.

To obtain a mirror-finish reamed hole in brass or bronze, stone the corners of the reamer to a 1/16-in. radius and float carefully by first slightly chamfering the edge of the bore. Of course, the reamer must be correctly ground to start with.

Don't forget that some machine parts which are exposed to wear can be made of cheap steel, then chromium plated, and answer the purpose fully as well at one-third the former cost.

To thread a hole accurately by hand, grind down a section of a discarded tap to the drill diameter, chamfer, and cut three or four full threads before using the good tap.

ELECTRIC TIMER TO JOG YOUR MEMORY

(Continued from page 85)

same outside diameter as the ring. The inside diameter of the cardboard ring, however, is slightly more than that of the wooden ring, and, when glued in place, it leaves a rabbet to receive and support the glass crystal protecting the clock's face.

The glass is held in the rabbet by a ring of thin sheet brass, which may be cut out with shears and attached to the wooden ring with six very small screws, the heads of which should be countersunk to preserve the smooth surface of the brass. (If a lathe is available, the wooden ring may have the rabbet turned in it, and the brass ring may be cut on a wooden faceplate, instead of being cut with shears.)

This brass facing not only secures the glass, but serves as an electrical conductor. The perspective circuit diagram shows the conductor ring, the switch or silencer, the battery cells, the buzzer, and the sheet brass and wire leads or connections. The circuit is normally open, of course.

The bent brass contact member, which is attached to the conductor ring, is brushed by the minute hand of the clock to close the circuit at any time within one hour, but for extending this period to two hours, another device has been developed. This comprises a swinging shield member, of insulating material, mounted as shown on a small shaft extending through the wooden ring and occupying a position directly back of the brass contact member. To extend the time to more than one hour, the shield is moved by means

of a knob to a position where it prevents the moving minute hand from touching the brass contact. Instead, the minute hand is carried under and around the brass contact, thus delaying the making of a contact until the second complete round of the minute hand. Since the shield was moved out of the way the first time the hand passed, the hand now brushes the brass contact, and the desired call is sounded.

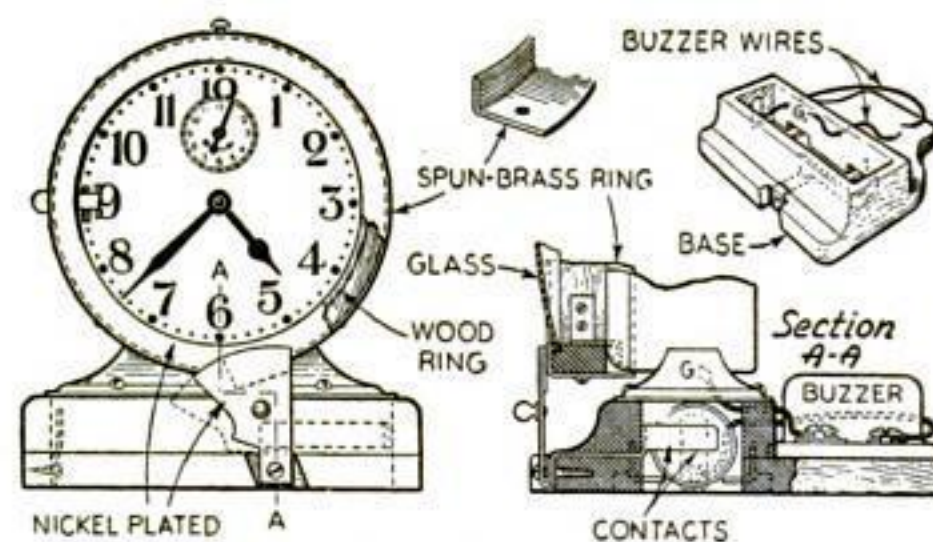
THE conductor ring is turned bodily anti-clockwise to bring the contact member opposite the time on the clock dial at which a call is desired. The ring should be lightly pressed against the clock while turning it. The setting operation automatically swings the switch or silencer upward (by friction contact) and in so doing puts the electric circuit in readiness to set off the buzzer when the minute hand engages the contact element. This upward movement of the silencer simultaneously with the setting operation is of importance because it leaves the operator only one thing to do, which is to turn the conductor ring. After the signal has been sounded, the silencer is pushed down by hand to break the circuit. Before using the clock, be sure to wind it fully.

Two short wires will be noticed in the drawing protruding from the clock case. These may be connected by small clips with long circuit wires extending to a suitable electric switch, if desired. One of the wires is attached to the battery lead in place of the buzzer wire (which may be disconnected), and the other wire is grounded to the clock.

How to make a switch is another story, but the author uses a homemade one operated by the timing element and the dry-cell battery of the clock. This can turn on electric lights, set the dampers of a heating plant, or start a radio set which has been previously tuned to the desired station. Many similar arrangements are possible.

A satisfactory finish for the clock attachment is a dark brown stain for the wood portion, and a brown oxidized finish for all the brass parts, including screws and hooks. Any plating concern can finish the metal parts at a moderate cost.

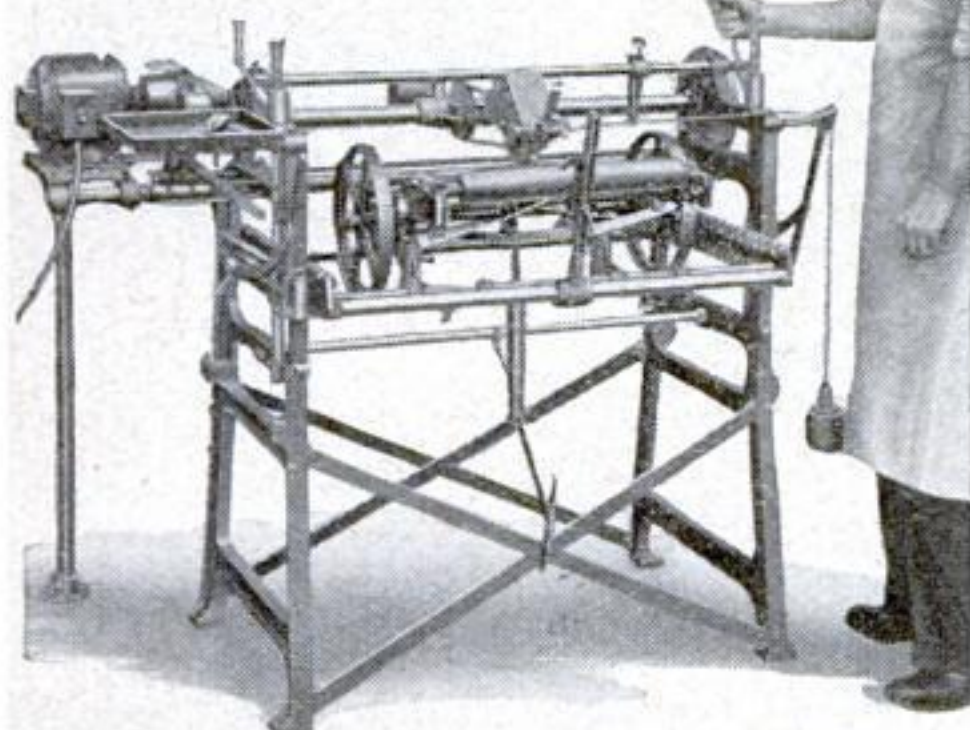
For the benefit of those who prefer to use a more modern and beautiful clock than the one illustrated, a small drawing has been added. With this type of clock, a smaller baseboard may be used, and the battery cells are placed in a compartment underneath the clock instead of behind it. The principle of operation is practically unchanged. One important difference, however, is that the operating ring is narrower, its outside diameter being the same as that of the clock case, and the brass



How to modify the design and improve the appearance if a modern alarm clock is available

conductor and glass-securing ring is made cup-shaped by a metal-spinning operation. By this means the brass facing on the wooden ring is extended over the outer edge of the ring on which it fits closely and is of a width sufficient to reach over the front edge of the clock, thereby constituting a substitute for the guide pins. It is secured on the wooden ring by three or four small wood screws. The finish of the metal parts of this clock should be nickel or chromium instead of oxidized in order to carry out the modern effect.

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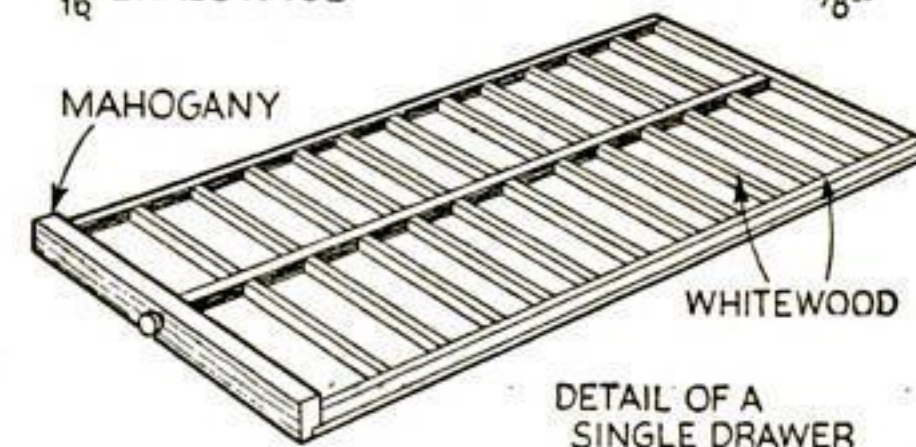
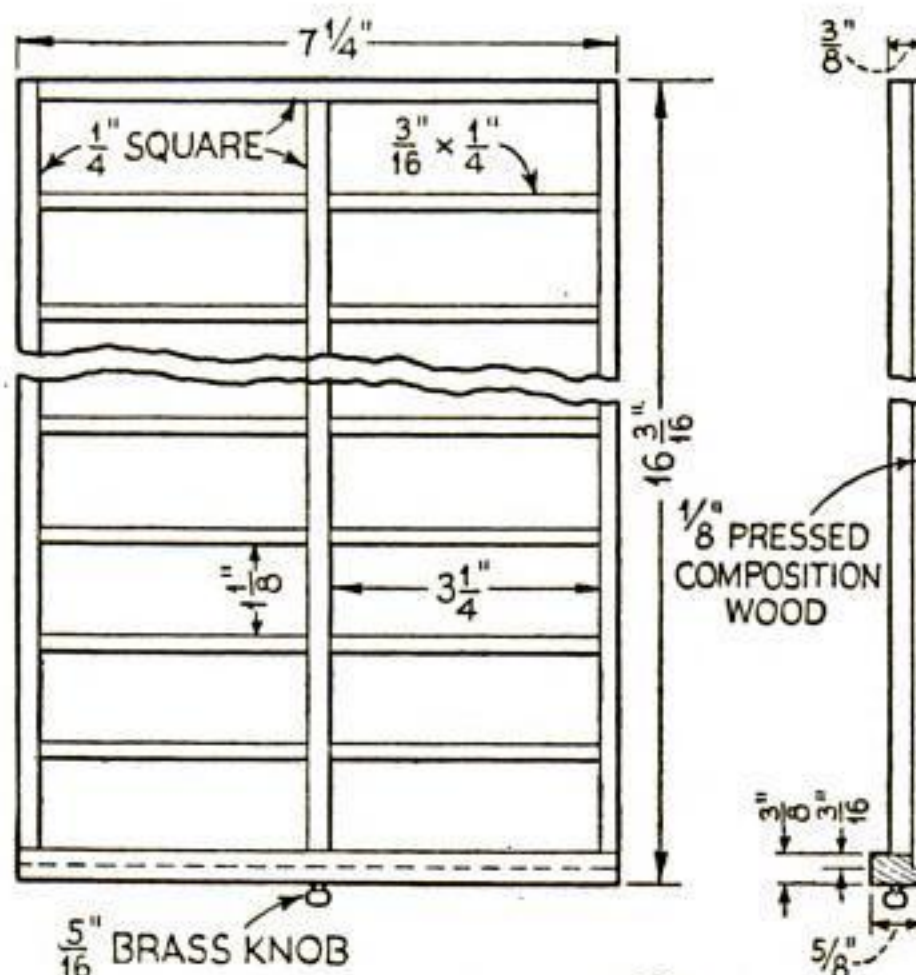
(Continued from page 81)

plugged with wood composition or small pegs.

The back and the door are next cut and fitted. In fitting the back, which is approximately 7 3/8 by 7 1/2 in., remember to cut the mortise for the angle iron.

Coat the inside of the cabinet back of the front line of the drawer slides with linseed oil to insure good waterproofing. Do not oil the inside of the door or the part of the cabinet that will be visible outside of the drawers. For these parts and for the outside, you can use a dark water stain. Five or six coats of thin, clear shellac are applied, irregularities being removed with sandpaper.

Drawers. Make ten fronts 3/8 by 5/8 by 7 1/4 in. At the rear of the bottom edge, cut a



One of the drawers with its twenty-four sub-divisions, and dimensioned top and side views

rabbit across the entire edge, 1/8 in. deep and 3/16 in. toward the front. The thickness of the drawer bottom is 1/8 in., and the 3/16 in. allows space for nailing the bottom to the front. Next, from a suitably large piece of 1/8-in. composition board, cut ten pieces 7/4 by 16 in. Then use five 1/2-in. wire nails driven in a slanting direction to attach the bottoms to the wood fronts.

From whitewood 1/4 in. square, cut the sides, ends, and center partitions of each drawer. Using 5/16-in. nails, glue and tack through the composition board into the wood strips. Do not countersink these nails. Cut and fasten strips of whitewood 1/4 in. deep and 3/16 in. wide for the small individual partitions, which will make the filing spaces 1 1/8 by 3 1/4 in., or slightly longer and wider than a standard 1 by 3-in. slide. To secure the front, drill small holes through it into the sides and drive 1/2-in. wire nails through, countersinking them and filling the holes. These nails are likely to split the side partitions unless a small clamp is tightened on the partitions from top to bottom while driving them.

After sandpapering the drawers, screw small 5/16-in. brass knobs in the exact center of each drawer front. Stain all visible parts of the drawers. The bottoms need no stain and only one coat of shellac. Three coats of shellac are enough for the inside and the front. Rubber feet and a 5/8-in. brass door knob and escutcheon finish the job.

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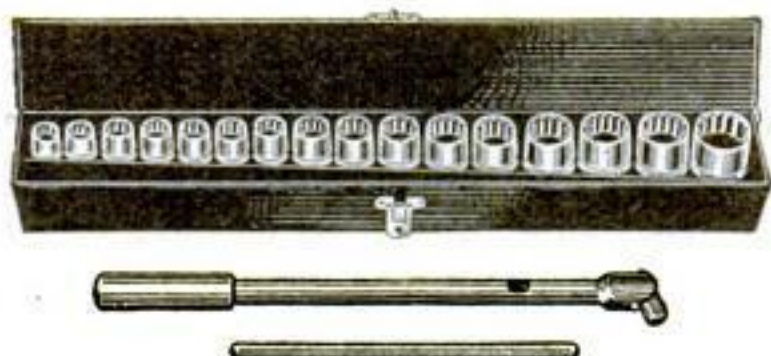
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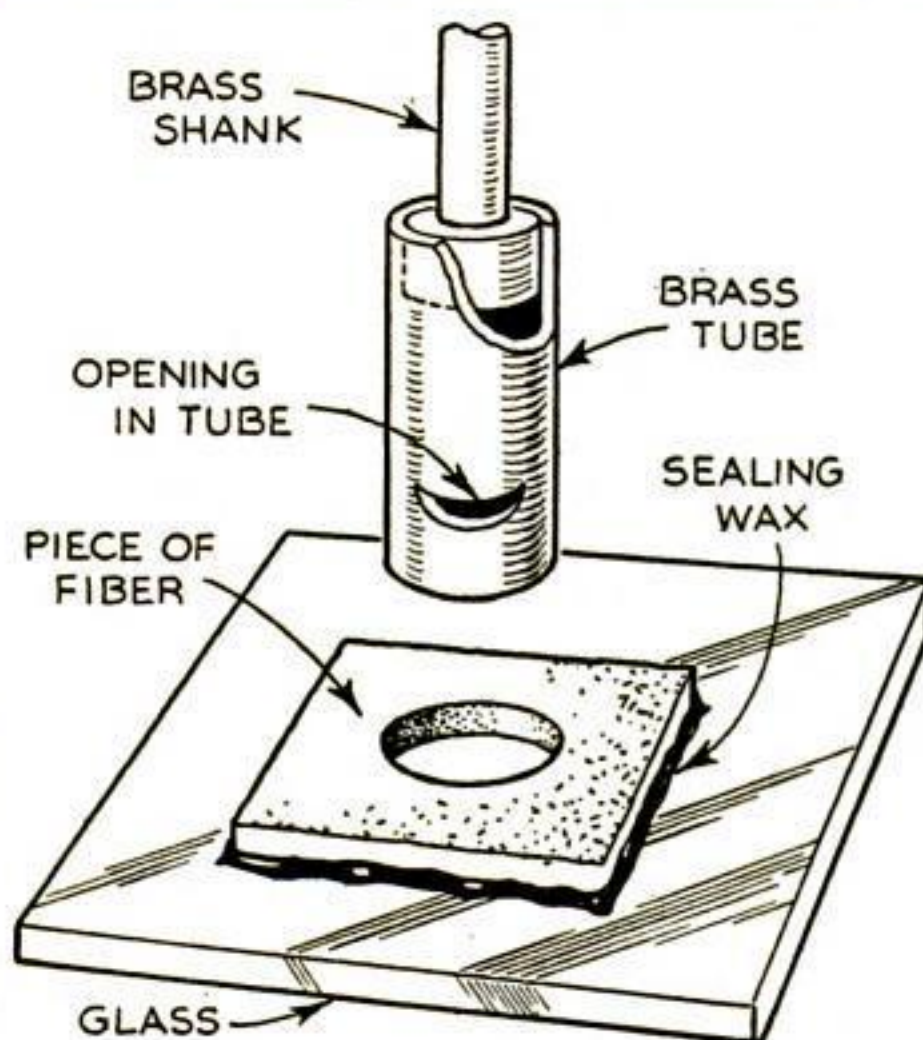
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SOLUTION MAKES GLASS EASIER TO WORK

GLASS may readily be filed, bored, or even sawed with a fine-tooth hack saw if the following solution is mixed for use as a cutting fluid: 2 oz. pulverized camphor, 6 drams sulphuric ether, and enough oil of turpentine to fill a 6-oz. bottle.

To bore holes, first drill and ream a hole of the desired size in a flat piece of fiber, and fasten the fiber to the glass by means of sealing wax with the hole over the correct spot. A short length of brass tubing of the proper size for a running fit in the fiber is provided with a shank to fit the chuck of the drill press. An opening is made in one side of the tube a little above its lower end, as shown. If the bottom of the tube is notched, thick glass can be cut more easily.

Place the glass on the table with the jig attached and with a piece of thin wood or cardboard beneath. About a spoonful of ordinary silicon-carbide abrasive powder is then poured into the opening in the side of the tube



Glass-boring tool with opening through which the abrasive and cutting fluid are injected

after the tube has been lowered to the top of the fiber. Start the press slowly and pour some of the special solution in through the hole as the boring begins. In a surprisingly short time, the hole will be ground through. When the tube is removed, a blank of the glass will be found inside, and the opening in the tube enables it to be pushed out from above. Disks of any size may be made in this way for microscope work, lenses, and the like.

Large show windows that are cracked are sometimes temporarily repaired by drilling a hole in the glass and applying washers or a brace behind the fracture. To drill such a hole, use the cutting tube in a small breast drill. Fill the tube about one-third full of the solution and abrasive material, and cover the opening with tape.

In model work it is sometime desirable to fit irregular places with glass, and this may be easily accomplished by wetting a file with the solution—a bastard file for thick glass and a mill file or similar cut for thin. To saw glass, place a thin board on each side of the piece to be cut and use a slow stroke, keeping the fine teeth of the blade wet with the solution.—GEORGE J. MURDOCK.

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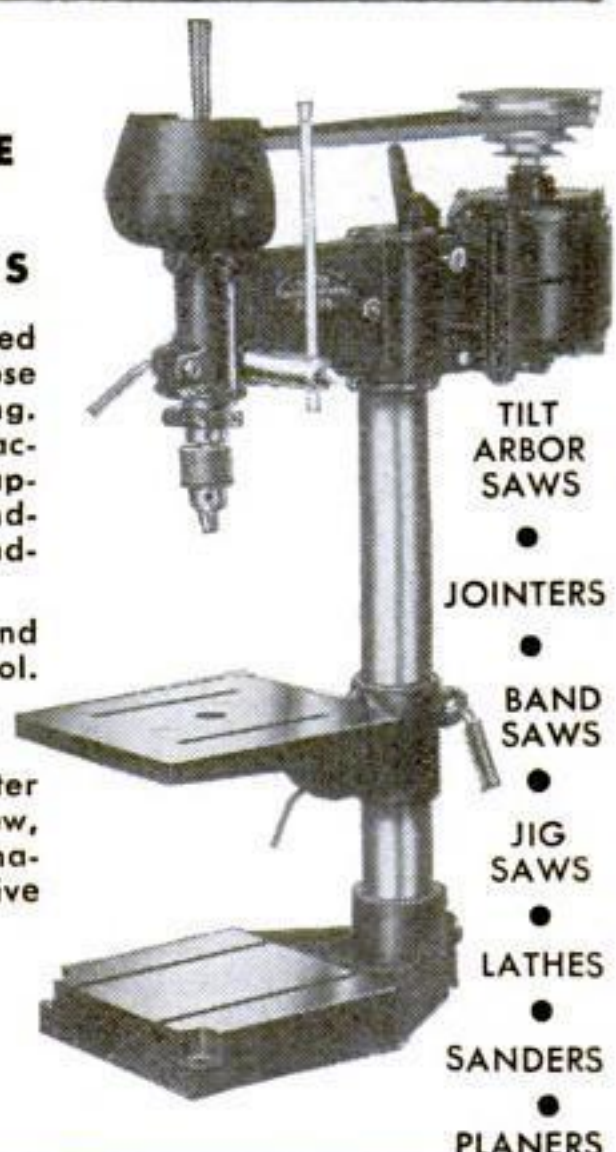
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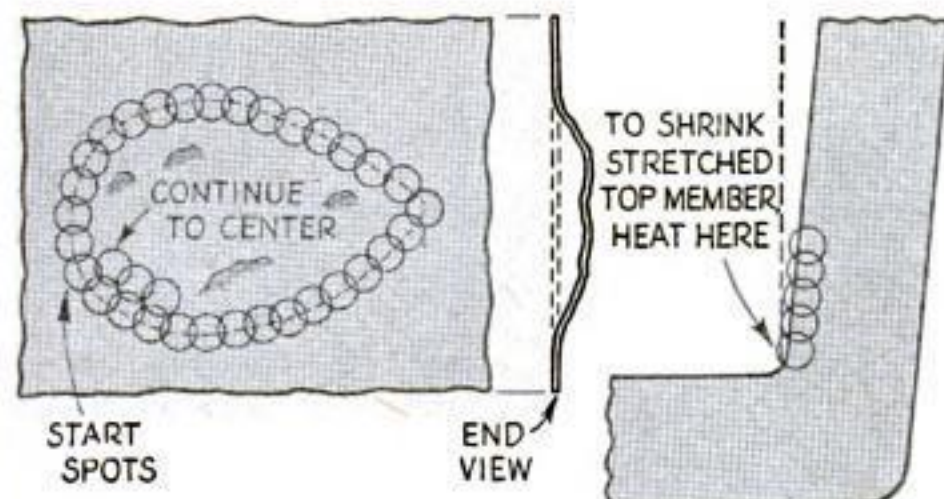
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HOW TO SHRINK DENTS IN AUTO BODIES

WHEN a dent is made in a piece of sheet steel, such as an auto body, the metal is stretched. The only way the damage may be repaired is by shrinking the metal to its original condition. This may be readily accomplished with the acetylene torch, a smooth-faced copper hammer, and a block of steel.

Place a small tip in the torch and adjust to a neutral flame. Starting at the outside edge



Diagrams show method for removing dent or straightening out a stretched angle piece

of the dent, heat a small spot (about the size of a dime) red hot and at once place the smooth steel block below and strike the hot spot a sharp blow with the hammer, taking care to strike the spot squarely. Repeat this operation, allowing each spot to overlap slightly the one before. In this way follow around the dent. When the first circuit is completed, repeat with a second circle inside and just overlapping the other circles. Complete this circuit and continue until the center of the dent is reached.—W. C. CHENEY.

LEAKY SHINGLE ROOFS

(Continued from page 90)

and any water that is still flowing down is forced to back up until it works under the shingles and into the building. Ceiling insulation, of course, will help to some degree, but is not sufficient in itself to effect a complete cure.

The shingles should be removed for a strip of about 3 ft. 6 in. all along the edge of the roof, or from a still wider strip if the overhang is greater than usual. Should the shingles be laid on shingle lath or on spaced sheathing, it will have to be removed also and this portion of the roof boarded up solidly to afford a good bed. A strip of roll roofing is now laid on the exposed portion of the roof. A generous coat of asphalt roof "dope" or cement (of brushing weight) is applied to the roofing material, and the shingles are then relaid.

While the finished job has the appearance of normal shingling, it offers an undersurface completely sealed to water. The asphalt cement on which the shingles are laid has the effect of sealing even the shingle nails themselves.

It is sometimes desirable and even imperative for economic reasons to use up some of the old shingles on a job of this kind. Often when reshingling a house, for example, many of the old shingles are found to be in good shape, and throwing them away seems to be extravagantly wasteful. The usual procedure is to lay them as far as they will go and then use new, but it is better to have alternate courses of new and old shingles. This insures more protection and longer life. The old ones should be laid with the previously weathered side down. They will lie flatter this way, because of the slight curve they developed in their old position. Furthermore, the exposed portion will match the new shingles much better.—R. O. LISSAMAN.

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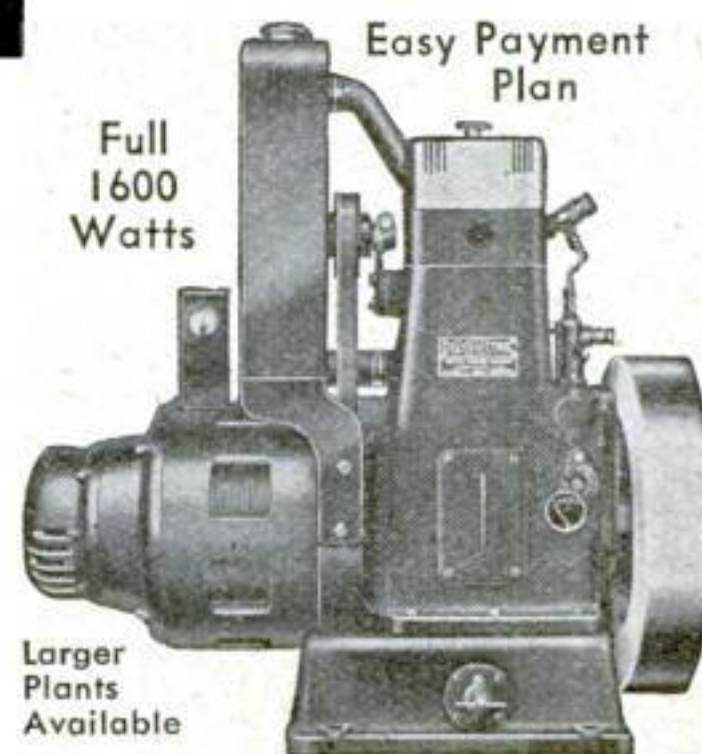
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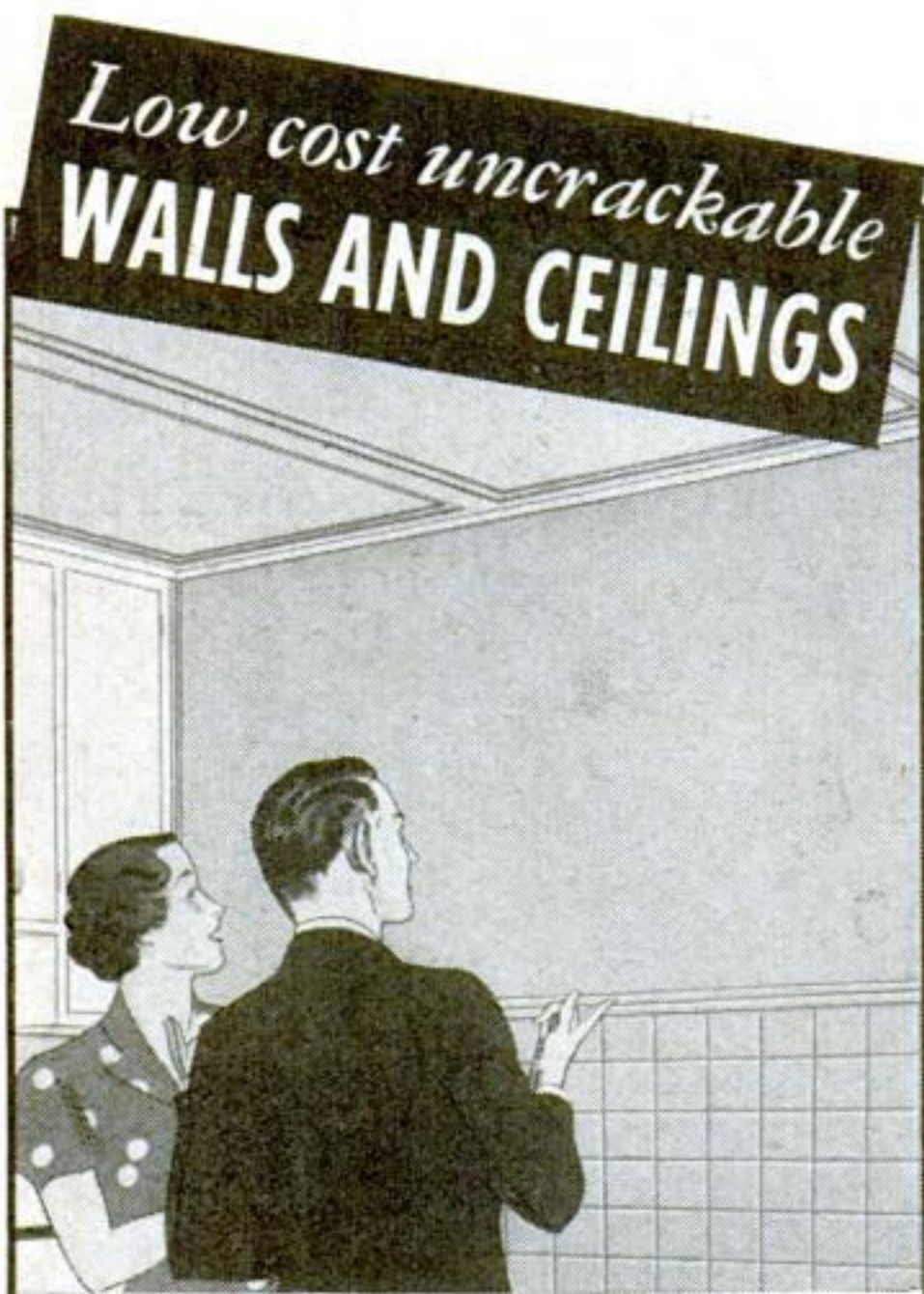
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**INSECT PHOTOGRAPHER
RECORDS LIFE DRAMAS**

(Continued from page 37)

For four days Passmore prowled around the gorge, seeking other bugs of the same kind. At last, on a cool April afternoon, he found a male. On its back he counted twelve oval objects smaller than pinheads. These, he discovered, were eggs. This discovery whetted his interest and, as he expressed it, he "ran up and down that canyon with my nose to the water for two and a half years." Accomplishing what? Exposing the complete life cycle of these interesting creatures to science and to natural-history fans.

HE CAPTURED hundreds of the bugs and carried them to his home laboratory, where he placed them in a tub whose bottom was lined with moss, sand, and gravel taken from the river bed and arranged to conform with the natural habitat of the insects. There, with lights shining from oblique angles to avoid reflections on the water's surface, he observed the female laying her eggs on the back of the male, the male sunning the eggs, and the young hatching. He controlled the temperature of the water by shifting the tub from sun to shade and back again, timed the period of incubation, and was on hand with his cameras to record the birth of the young.

Passmore lives among stirring dramas of the underworld, for most of the spiders and insects which he photographs make their homes beneath the ground. Some he observes killing their victims by quickly inserted doses of poison, others by sawing their bodies in two. Trapdoor spiders and tarantulas kill by the poison method, but solpugids, a strange link between the insect and the spider, possess jaws which work back and forth, literally cutting through a victim and quickly disposing of it.

He set up his camera early one morning in his own yard to record some of the habits of a solpugid. When he dismantled the equipment, some time later, he had photographed the stirring spectacle of a sow bug walking into the solpugid's grasp, to be torn apart by the sawing jaws.

While walking in his garden one afternoon, Passmore saw a robber fly pursuing a blue-bottle fly. Sensing impending tragedy, he watched them closely. After a short chase, the robber caught the bluebottle on the wing, killed it, and settled on a near-by stone to enjoy its succulent juices. From his laboratory, Passmore hurriedly brought a camera and set it up with the lens peering down on the scene not six inches distant. As unconcerned as any human eating a meal at home, the robber fly rolled the bluebottle over and over, taking from it such substance as it wanted, then made off to look for new prey.

MANY of these little dramas are not acted during the day. Often the naturalist roams through his yard and garden after dark, searching out interesting insects with quick flashes from a light. The other evening, he came upon a katydid cutting with her mandibles into a leaf of a lantana bush, making ready to deposit her eggs. Again, he produced camera and flash lights and caught her in the act.

For these little creatures, the conditions of life are far more stern than those faced by humans. Passmore's photographs prove again and again that only the fittest survive. Take earwigs, which live under stones and whose forked tails are potent weapons of defense. These Passmore photographs by the comparatively simple method of turning stones over and pointing the camera down. In this manner he has pictured earwigs at home, and their tiny eggs, scarcely a sixteenth of an inch long, hatching out white little earwigs which within about thirty (Continued on page 125)

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INSECT PHOTOGRAPHER RECORDS LIFE DRAMAS

(Continued from page 124)

minutes become as black as their parents.

"But there comes a time when an enemy intrudes," Passmore told me. "More than once, as the camera stood ready to record the birth of young earwigs, ants have walked boldly into the scene. Occasionally one gets away with a few eggs, but usually the female earwig catches the marauder. With the nape of his frail neck between the forks of her tail, she cuts him in two, and throws him aside—almost in the twinkling of an eye."

This man's observations and pictures have disproved many fallacies about insects. They show, for instance, that young cockroaches escape from their eggs without their mother's help, once thought to be necessary for this vital operation.

PASSMORE brought several cockroaches into his laboratory and there observed their life processes. Close by his lens they laid eggs, eight in a row on each side of their sac. Forty-two days later, he saw the young begin to emerge by pressing open the folds of the egg case. As each escaped, the case closed again, remaining shut until another by his own efforts exuded a fluid which softened the cement holding the case together.

For final proof that the mother's aid is not needed, sixteen little roaches were hatched within a glass vial. Of these, ten escaped through an opening in the cork no larger than a pin point. Others, in a second group, escaped by eating through the cork, tiny and weak as they were.

Perhaps the most vicious of all the subjects photographed by Passmore is the wolf spider. At least, his appearance is most forbidding, particularly when you look at a picture of his face and head many times enlarged. This spider, possessed of eight eyes which give him a sharpness of vision enjoyed by few insects or spiders, either lurks near his nest to pounce upon prey, or runs his victim down, killing and devouring it much as the tarantula does, except that the tarantula strikes downward with his fangs much after the manner of a rattlesnake. The wolf spider squeezes his fangs into his captive from the sides.

Sitting in the laboratory and looking at hundreds of lantern slides which Passmore has made from the best pictures in his large collection, I commented on the forbidding appearance of the wolf spider.

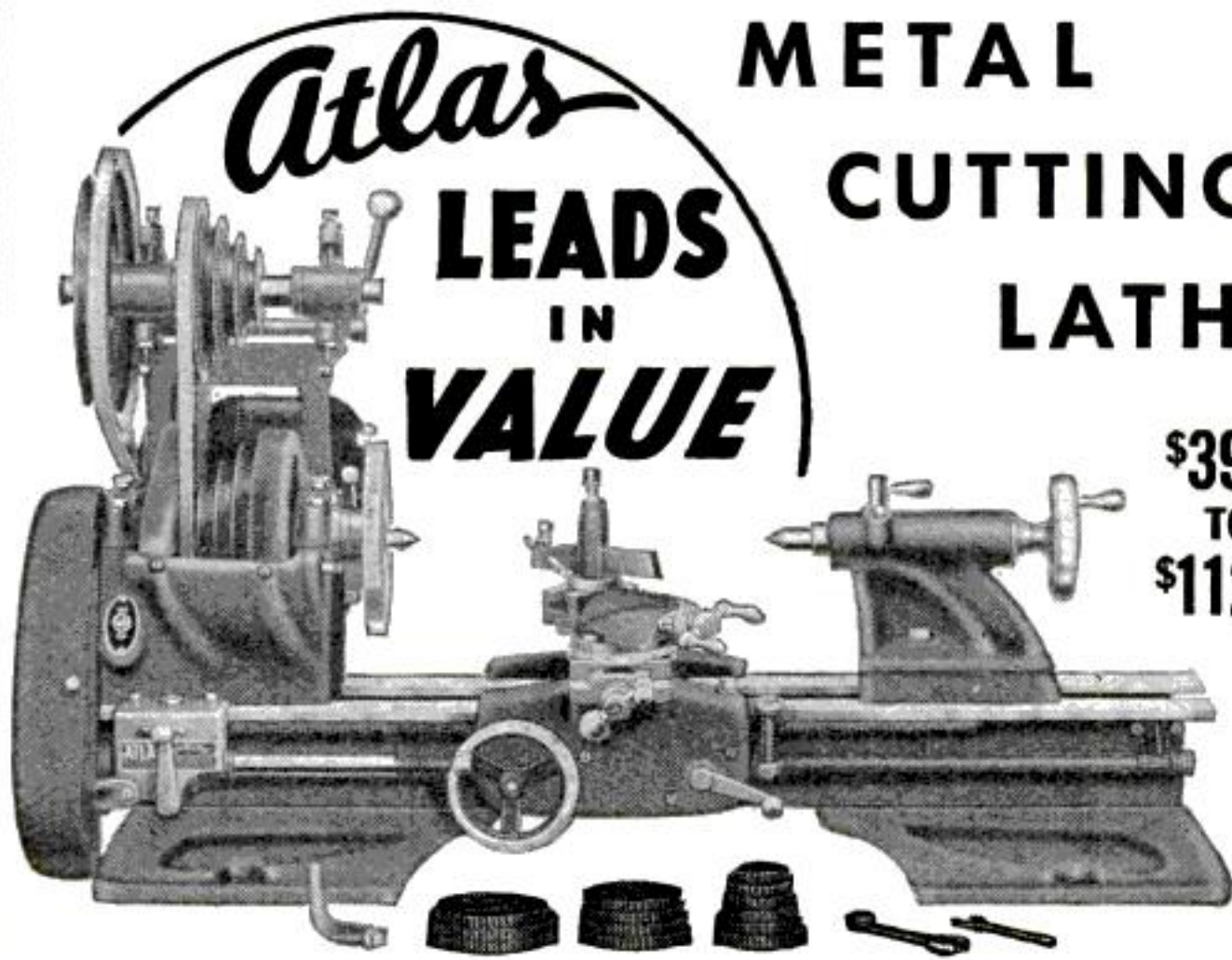
"She is relentless, voracious, a real killer," he declared. "I have seen them attack cockroaches and crickets, and roll over and over in the struggle. But I have never seen a wolf spider vanquished. Soon she presses her fangs into the victim, emits a small amount of poison, and carries the unconscious victim away to the feast. I saw one bite the head from a fly as casually as man eats bread. Yet these spiders have a strong family instinct and carry their young on their backs until they are ready to take care of themselves."

PASSMORE, whose work as a photographer-naturalist has made him internationally known, treats all his subjects as friends. He handles black widow spiders with the same ease as he does their non-poisonous relatives, though he does not recommend this practice. He has been stung by tarantulas, but only when they struck back to avoid injury.

"Poison from these insects and spiders, except the black widow, while toxic to others of their kind, affect a human being little," he assured me. "But they seldom bite. See..."

He picked up a tarantula and swung it around the laboratory. Suddenly he thrust the creature into my hands. I could feel the throb of its body against my flesh.

"What did I tell you!" he exclaimed. "Quite tame. And isn't she a beauty?"



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EXPERIMENTS IN COLOR SHOW CHEMICAL TESTS

(Continued from page 69)

graduated measuring cylinder, a glass vase, or a lamp chimney closed with a cork at one end. If you use a cylindrical graduate, one of 1,000-cubic-centimeter capacity works best.

Fill the container nearly full with a solution of sodium thiosulphate, or photographer's hypo, made up in the proportion of one gram of the chemical to every 100 cubic centimeters of water. Then support the vessel over a thirty or forty-watt electric lamp. The bulb should be inclosed in a tin can so that its light is shielded from your eyes but shines upward through the liquid. Mount an ordinary mirror, tilted at an angle of forty-five degrees or so, above the mouth of the glass cylinder. This will enable you to look straight down through the solution, in addition to observing it from the side through the wall of the container.

To perform the experiment, dilute three cubic centimeters of hydrochloric acid with enough water to fill about one third of a drinking glass with solution, and stir. Now pour this into the hypo solution in the glass cylinder, stir again, and await the color changes that follow.

AT FIRST the solution seems clear, and its appearance in the rays of the lamp may be likened to full daylight. Soon a cloudiness develops and the solution becomes slightly turbid. This is accompanied by a yellowing in color, which gradually deepens, like the glow at twilight. In several more minutes the color becomes reddish in hue, and its dimming brilliance resembles the red sunset. The series of changes takes from five to fifteen minutes, depending upon the temperature and strength of the solution.

In this reaction, the acid solution acts upon the hypo solution to form microscopic particles of sulphur. These suspended or colloidal particles appear to grow together gradually into larger ones, producing a change in the refraction of light and in the colors observed. The tints you see will vary, depending upon whether you view the solution from the side or from above, with the aid of the mirror. Ten hours or so after the experiment, you will find a whitish precipitate of sulphur at the bottom of the cylinder, and the liquid will be clear.

Another way to perform this experiment is to use a round fish bowl as the container, illuminating it from the side with a flash light held against the glass. This arrangement, incidentally, can also be used to show the optical behavior of rays of light passing through lenses, as the colloidal particles of sulphur in the liquid outline the flash-light beam with striking clearness.

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SOUTH BEND

NAVY-YARD APPRENTICES

(Continued from page 57)

annual promotion of successful apprentices.

At the school, work, study, and pay begin immediately. During the first year, an apprentice receives \$2.40 a day, five days a week. The second year, he receives \$3.20 a day; the third, \$4.00; the last year \$4.80 a day. The first 2,156 hours is a trial period, during which an apprentice may quit his apprenticeship merely by resigning. After the trial period, an apprentice may not resign honorably without special permission from the authorities.

To learn at first hand what was being done in these extraordinary vocational schools, I recently visited the Brooklyn, N.Y., and the Philadelphia, Pa., navy yards, two of the most active yards on the Atlantic Coast, where apprentice schools have been developed to a high state of perfection.

THERE, under the guidance of naval officers, mechanics, teachers, and apprentices, I went through classrooms and shops, testing laboratories, and ships under construction. I saw how more than 200 boys could work, study, conduct their mutual business and social affairs, and earn a living at the same time—enjoying themselves all the while because of an enthusiasm for their work.

Although training only civilian workers, each apprentice school is established by authority of the commandant of the yard, and its general policies are supervised by a commissioned officer. It is interesting to note here that Lt. Comdr. J. J. Redington, in charge of apprentice training in the Brooklyn, N.Y., school, began his career as an apprentice ship carpenter, a number of years before he joined the Navy.

In the shops, students are taught by master mechanics under whom they are placed by superintendents or shop masters. Correlating the shop work with the classroom work is a Supervisor of Apprentices, an industrial worker selected for his wide knowledge of navy-yard activities.

One of the striking things about the theoretical training at the Navy Yard Apprentice Schools is the almost complete absence of classroom instruction. The working material is so different for every trade, and the number of students is so limited in each, that the teacher must guide and check each apprentice individually. One apprentice traces out the electrical wiring diagram of a Coast Guard cutter; another studies the problem of casting a propeller for a cruiser; while a third may be writing a thesis on industrial safety. Theory is not based upon imaginary projects, but upon actual work requirements which a student encounters in his shop.

Occasionally, however, a class may be called together to listen to a talk by some visiting expert, to discuss problems of interest to the group, or to watch motion pictures of some subject related to its general work.

VOCATIONAL skills are taught through experience on actual construction going on at the time in the yard. Assignments are made according to regular shop-training schedules, which are in turn based upon an analysis of the duties, knowledge, and skills required in each trade. They include layout and fabrication work in the shops, outside work in the dry dock, shipways, and fitting-out piers.

Besides giving a boy training enough to earn a good living at some chosen shipbuilding trade, the Navy Yard Apprentice Schools aim to awaken that fine spirit of craftsmanship that has followed the whole history of naval construction. While the curriculum of apprentice training has changed in approach and subject since the days of Joshua Humphreys, it has merely dressed the old spirit in modern clothes to meet the complex demands of today's Navy.

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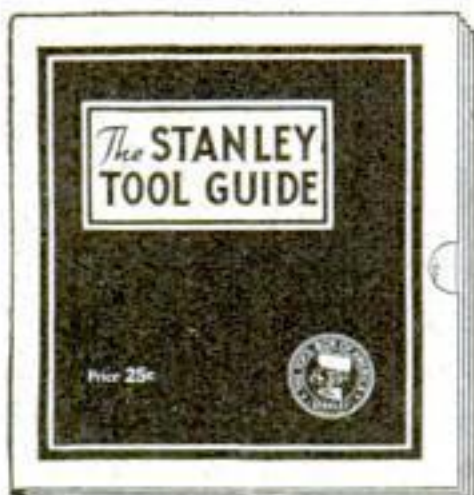
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RAISE YOUR OWN WOOL ON A BACK-YARD RANCH

(Continued from page 51)

fact, that are ordinarily made from yarn. Also, you can easily produce fluffy, snow-white pelts for beautiful furs, especially neck pieces, from Angoras. The wool is finer than silk and wears better than most rabbit fur. By feeding properly and giving the animals good care, you will be repaid in the fineness of the fur.

In order to save the pelt, after killing the rabbit, slit down the insides of the legs with a small knife and also about the neck; then, by peeling down the fur over the legs and hind quarters, strip the fur from the body, leaving the flesh side out. Where necessary, use the knife to separate skin from flesh, particularly along the abdomen. A pair of pruning shears will be useful in severing the feet. This is known as a "cased" skin, and is more easily dried and brings a better price than those slit down the front.

SPECIAL wire stretchers may be purchased for stretching cased skins, or you may easily make your own from wire or a board. Use either eight or ten-gauge galvanized wire, and bend it around a rod the size of your finger, making a complete loop and leaving twenty-three-inch prongs projecting at the ends slightly out from parallel. A board rounded to shape and fitting the average-size pelt, may be used, but drying will be slower.

Place the pelt, inside out, over the stretcher, legs on one flat side, back on the other. Hang in a dry place until all moisture has left the skin. This will take about ten days.

It is important to know when the rabbit will yield a good pelt. As a general rule, it will do so at any time except when molting. Molt in the pelt is usually noticed as a break in the ticking. If the pelt shows no ticking, a gentle pull of the fur near the rump may show loose hairs. Blowing into the hair should show new hair at the base near the skin. A dark discoloration of the skin before or after dressing usually indicates molting.

Since the first molt starts when the animal is six to eight weeks old, the pelt will be in good condition previous to this first molt, and will be ready for use again when the rabbit is about six months old. Best furs are taken between October and April from rabbits approaching six months of age. Pelts giving fur about an inch and a half long may be made into beautiful, silky jackets and various fur pieces. Coarse and thin fur should be avoided; likewise, the color of the fur should be uniform and free from hutch or blood stain or sun injury.

IF YOU do not wish to send your fur to a professional tanner, make sure it is well-fleshed at the beginning of the curing process. Place it in a bucket half-filled with water containing a handful of common salt. Leave the skin in the water until it becomes quite soft, then place it on a flat board and with a blunt knife or a pumice stone detach the tissues from the skin, beginning at the hind legs at the edge of the skin. Take care not to tear the skin while removing the tissue.

With the skin thus prepared, you now may make your tanning solution, using four ounces of chrome alum, one and one eighth ounces of ordinary soda, and eight ounces of ordinary dextrine. Place each of these ingredients in a separate twenty-four-ounce bottle, fill each with water, and shake the alum until it has dissolved. Take three ounces from each bottle, adding the soda to the alum, always stirring, then add the dextrine.

Pour twenty-four ounces of cold water into a bucket, add half of the liquid, and place the skins in this solution. Move the skins occasionally to make (Continued on page 129)

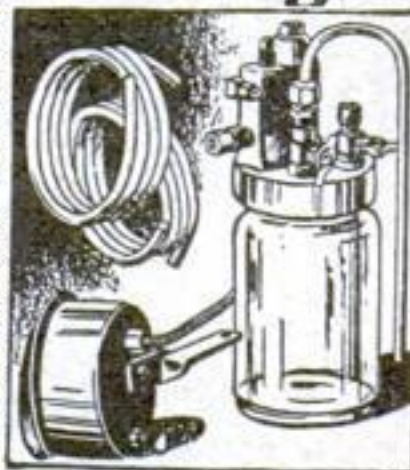
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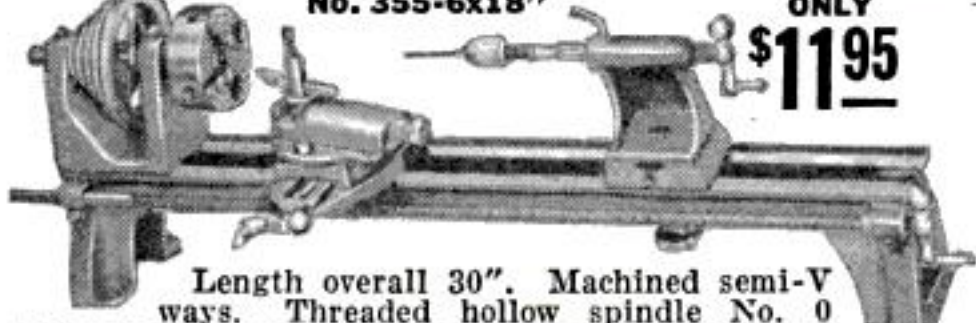
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RAISE YOUR OWN WOOL ON A BACK-YARD RANCH

(Continued from page 128)

sure they are thoroughly saturated. Let them stand twenty-four hours, and add the rest of the solution. The entire nine ounces of tanning liquid is now mixed with the water. Let this stand another twelve hours, but not more than twenty-four, and by that time the skins will be well tanned. After removal, wash the skins thoroughly and place them in a second bucket containing a mixture of chalk and water. Leave them for one hour, then wash the skins in cold water.

Because the pelt has now been softened, it should be worked over a board and wrung out and twisted until it becomes quite dry and pliable. To assure return to its former luster, work in one part of neat's-foot oil to two parts of Castile soap dissolved in water. Following this, the pelt may be hung up in a moderately warm place for drying, after which it may be worked again until all hard spots have disappeared. All traces of grease and dirt should then be removed, which can best be accomplished by placing the skin in a box of fuller's earth and shaking it well several times. After about two hours, remove the skin from the box, shake it well again and brush out all traces of the clay.

BY FOLLOWING the twelve rules below, offered by the University of California College of Agriculture, you will be able to produce finer Angoras at lower cost:

Buy stock from a reliable breeder. If in doubt, inquire of the breeders' associations. Start with only one breed. Do not attempt to mix Angoras with others.

Keep hutches dry, sanitary, free from drafts; provide plenty of sunlight.

Isolate all sick or diseased animals and destroy those which cannot be cured; do not change feeders or dishes from one hutch to another without first disinfecting the equipment.

Use only mature rabbits as breeders and plan to raise four litters to a doe each year.

Use well-built, economical hutches, which will prove inviting to guests and prospective buyers.

Cull out all inferior stock and plan to improve the quality of your animals gradually by using only the best breeders.

Feed regularly and use a well-balanced ration.

Buy feed in quantity at the season when prices are lowest.

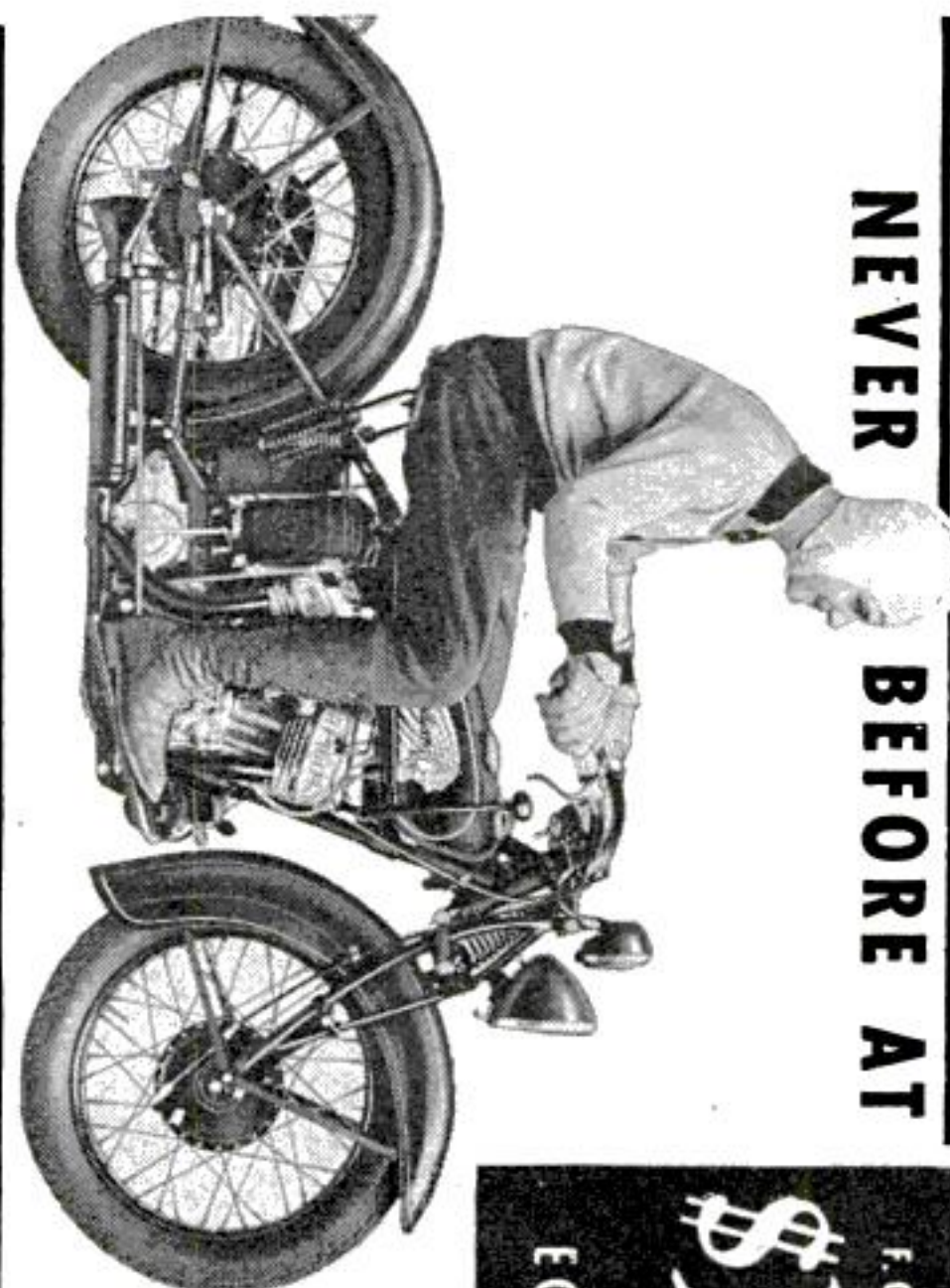
Maintain an economical unit and keep costs down.

Do not buy inferior or diseased stock at any price.

Do not keep does that have outlived their usefulness.

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ONE-CELLED sea plants acted as "electric eyes" in an interesting experiment performed recently by Dr. Gordon Marsh of the Carnegie Institution, Washington, D. C. Known as valonia, the sea plants are single units ranging from the size of a pea to that of an egg, and generating, like all living cells, a weak electric current. Specimens were placed in a light-tight box and connected by tiny wires to the circuit of a sensitive current-detecting instrument. When electric lamps were directed on them through an opening, the cells generated much stronger currents than they did in total darkness. When the intensity of illumination was varied, the cells showed a corresponding change in current produced. The plants are not a practical substitute for photo-electric cells, but the experiment may lead to important new discoveries concerning the electrical properties of living cells.



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Posed by professional model

YOUR CAR'S THERMOSTAT

(Continued from page 76)

handed it to Gus, who held it up to the light.

"How does this one work?" the car owner asked, as he squinted into first one end and then the other. "It hasn't any bellows at all."

"That works on a different principle," Gus explained. "See that coiled strip of metal? It's made by taking two pieces of different kinds of metal and sweating them together so they form a single strip with one metal on one side and the other metal on the other side. All metals, you know, expand more or less when they're heated, but they don't all expand at the same rate. Brass expands much more than steel does, for the same degree of heating. So, if you had brass and steel soldered together, and you heated the strip, it would bend more and more as it got hotter and hotter. In that thermostat, as the water heats up the strip, at a certain temperature it starts to bend and open the valve."

"HOW am I to know that it will open at the right temperature for this car?"

"I'll prove it to you," said Gus, walking over to a bench where some coffee had just come to a boil in a fat pot on an electric heating plate.

"Coffee's ready, Joe!" he called out to his partner, who had stepped into his tiny office. "Will you join us in a cup, mister?"

"Thanks, I will," smiled the car owner. "Garron's the name. Just moved into this town, so you wouldn't know me."

"Here you are, Mr. Garron," said Gus, as he handed him a cup of coffee. Gus put a small skillet of cold water on the hot plate in place of the pot. "Now, as I was saying," the veteran auto mechanic went on, "testing an auto cooling-system thermostat is a cinch. Just drop it into some cold water on the stove and stick a thermometer in beside it—where'd you put the thermometer, Joe? Ah, here it is! Then all you've got to do is to watch the thermostat. When it starts to open, you read the temperature."

Garron kept his eyes on the thermostat as he sipped the steaming hot coffee. In a few minutes he called out, "There it goes!"

Gus quickly read the thermometer. "One hundred and fifty-two degrees. That's almost right on the nose. The specified figure is 150."

"That double metal strip is something new, isn't it?" Garron asked.

"New!" exclaimed Gus. "You carry a good watch, don't you? Look at the balance wheel, and you'll see its rim is made the same way, so it'll automatically adjust itself to keep good time in both cold weather and warm. Fine watches have been made that way for years. Even the bellows idea of making a thermostat is old, too."

"YOU win," laughed Garron, as he put his empty cup on the bench. "Thanks for the coffee. Stick that thermostat in the car, and I'll get going. I suppose some day they'll make cars that don't need such delicate mechanisms."

"Maybe so," Gus grunted, "but I wouldn't call a thermostat a delicate mechanism. Besides, that isn't the only thermostat in your car. There's another one, working on exactly the same principle, that acts to cut the charging rate of your generator when it gets warm, and still another that works the automatic choke."

"That's right, now I come to think of it," Garron admitted. "One thing I never could get through my head, though, is how a thermostat can keep your motor really warm in cold weather. Of course, I can see how it would stop the circulation until the water around the cylinders got warm, but when the thermostat opens, why doesn't the icy-cold water rush in and make the motor stone cold again? Then, of (Continued on page 131)

NOW YOU, TOO, CAN LEARN TO PLAY MUSIC

... this easy as
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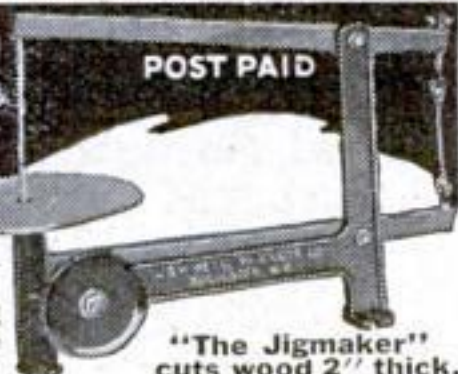
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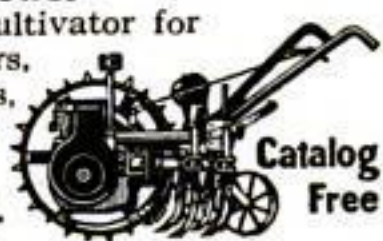
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MARCH, 1937

YOUR CAR'S THERMOSTAT

(Continued from page 130)

course, the thermostat would close and the water would start to warm up; one minute the motor would be hot, and the next minute cold, and so on."

"That's almost what does happen on a very cold day when you first start out," Gus explained. "If you'll watch the dash thermometer real close after the motor is started, you'll notice it creeps up to the warm point and then, as the thermostat opens up, it drops back quite a bit; then it creeps up again slowly to a position where it will stay as long as you keep the motor running."

"The reason the motor settles down to a steady temperature so quickly is because the thermostat doesn't snap open and snap shut. After the first swing up and down, it settles to a point where the opening is big enough so that the water flow will be just right to keep the motor at the correct temperature."

"AND that," Gus went on, as he tightened the hose connection, "is just another reason why you should let your motor warm up slowly and carefully when you start out in real cold weather. If you hop into a car where everything is chilled down to zero, and the minute she starts you shove her into gear and tear off down the road, the cylinder head and the upper part of the cylinder block get hot while the lower part of the cylinder casting and the rest of the motor are still below freezing. Lots of cylinder-head cracks show up right then, and if you're going fast when the thermostat opens for the first time, and the pump is working like mad, there's a rush of icy water that's likely to cause cracks, too."

"So, if you want your motor to last," Gus continued, "let it warm up slowly for a couple of minutes before you start from stone cold. That will give the heat a chance to work down the cylinder walls, and when the thermostat opens the pump will be working so slow that it won't shoot a couple of gallons of ice water into a hot cylinder and head jacket."

"How about putting one of these adjustable covers over the radiator? Would that help?" Garron asked.

"It will help to keep the motor warm longer when you stop, but it won't save the motor on a quick cold start," Gus maintained, "and if the thermostat is working the way it should, it won't help much, anyhow, at any temperature down to freezing. Of course, when the temperature is down to zero and below, then the flow of water through the thermostat is slow and the water is very cold where it flows in even after the motor has been running some time, so there is more difference in temperature than there should be between the cylinder walls at the lower end and at the cylinder head. The best cure for that is to cover up the lower third of the radiator with a regular adjustable cover or a piece of cardboard fastened to the core under the grill that you find in the new types of cars."

"THAT sounds reasonable," Garron agreed. "I'll let my engine warm slowly after this. But what are you going to do if you are in a big hurry to get started?"

"Hurry right off, if you want," growled Gus. "But remember that it may turn out to be a mighty expensive hurry!"

BEARING ALLOY FOR CARS

LONGER life for automobile bearings is promised by using a new alloy of silver, cadmium, and copper, instead of babbitt. Driving tests, it is said, indicate that use of the new material triples bearing life. Corrosion caused by organic acids in lubricants has delayed commercial adoption of the alloy, but automobile and oil industries are reported to be working to remove this objection.

THE SMASH HIT OF 1937



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MODEL
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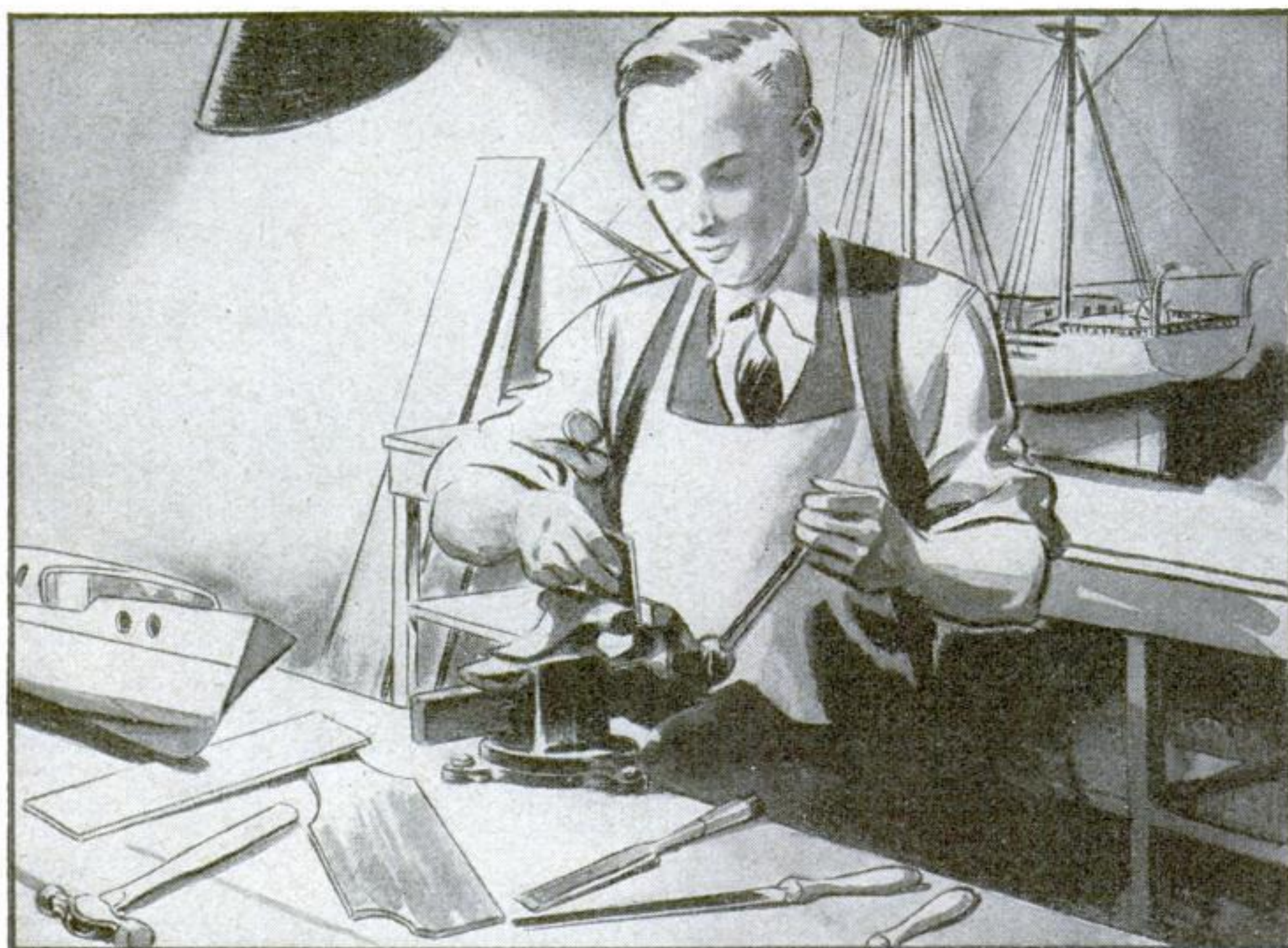
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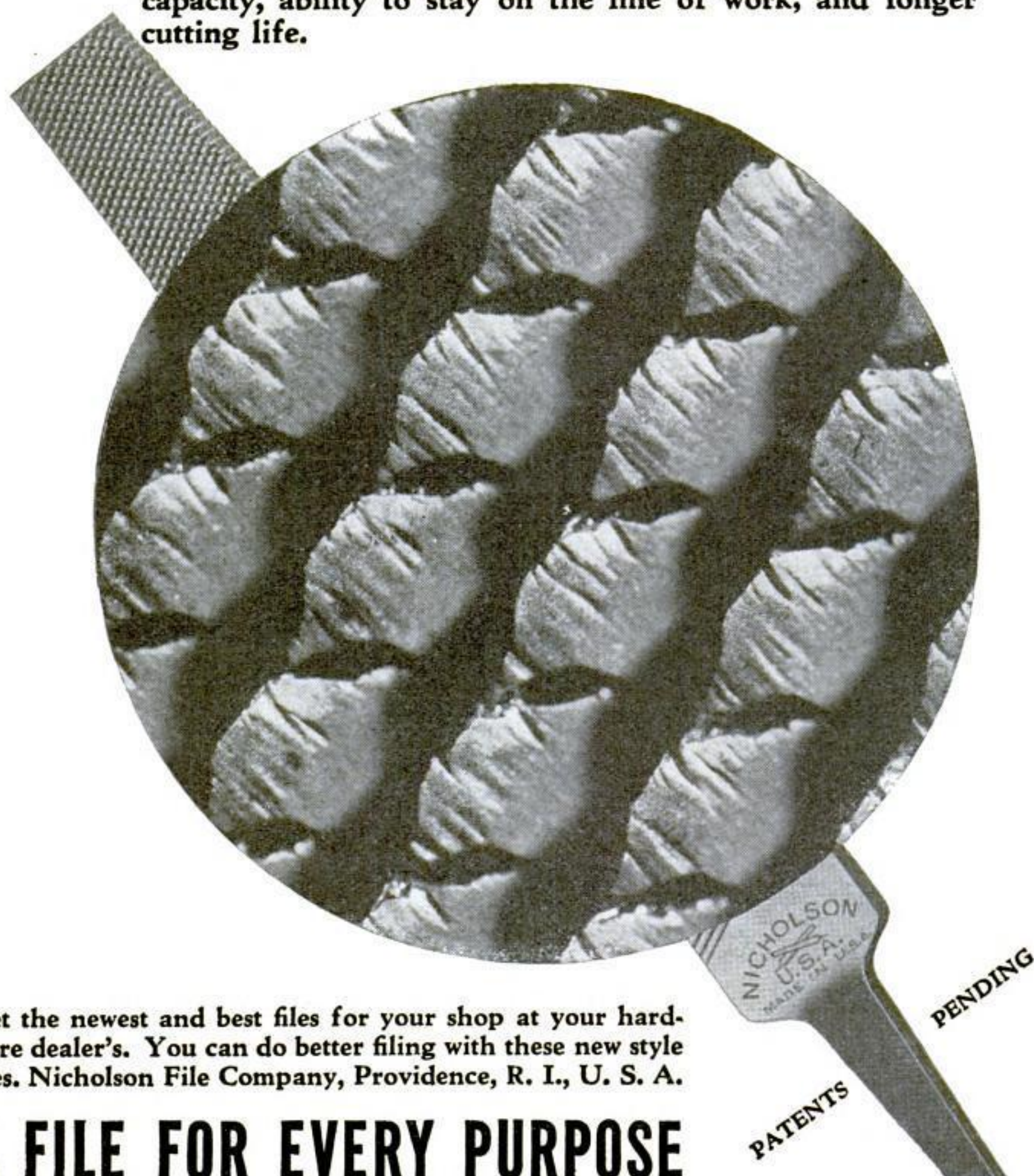
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A FILE FOR EVERY PURPOSE

STRANGE HYBRID CRAFT HUNTS OIL IN SWAMPS

(Continued from page 41)

plant, a standard eight-cylinder automobile motor of popular make was chosen. On roads or smooth ground it propels the marsh buggy at a speed of thirty-five miles an hour, through marsh land at an eight to ten-mile pace, and in the water at six knots. Its power is applied through a pleasure-car transmission and a tractor transmission, in turn, giving the machine ten speeds forward and six in reverse. Screens cover the radiator, generator, and air intake to keep them from becoming clogged by the white fluff from the bulrushes that grow in the marshes.

ENDLESS chains link the wheels on each side to provide a four-wheel drive and thus obtain maximum traction. By means of individual brakes, the wheels on one side may be stopped while the ones on the opposite side keep turning, enabling the vehicle to be steered in the water. On land, a steering wheel guides it like a conventional automobile. The front axle, pivoted at the center, tips sidewise to let the wheels ride smoothly over uneven ground.

Made to special order by a leading rubber firm, the enormous tires are inflated with air under three to five pounds' pressure, and are so resilient that the marsh buggy needs no springs. Permanent air lines lead from the tires through the wheel hubs to a pump, which may be turned on to blow up the tires while the machine is in motion. Relief valves on the tires make it impossible to overinflate them. In case of a small puncture, the pump will keep a tire filled with air until a convenient place is reached for repairs. The wheels themselves, made of aluminum and measuring sixty-six inches in diameter, are water-tight drums that provide reserve buoyancy in case of need. An aluminum body rests upon the standard automobile frame that constitutes the backbone of the vehicle, and many of its fittings also are of aluminum, to conserve weight.

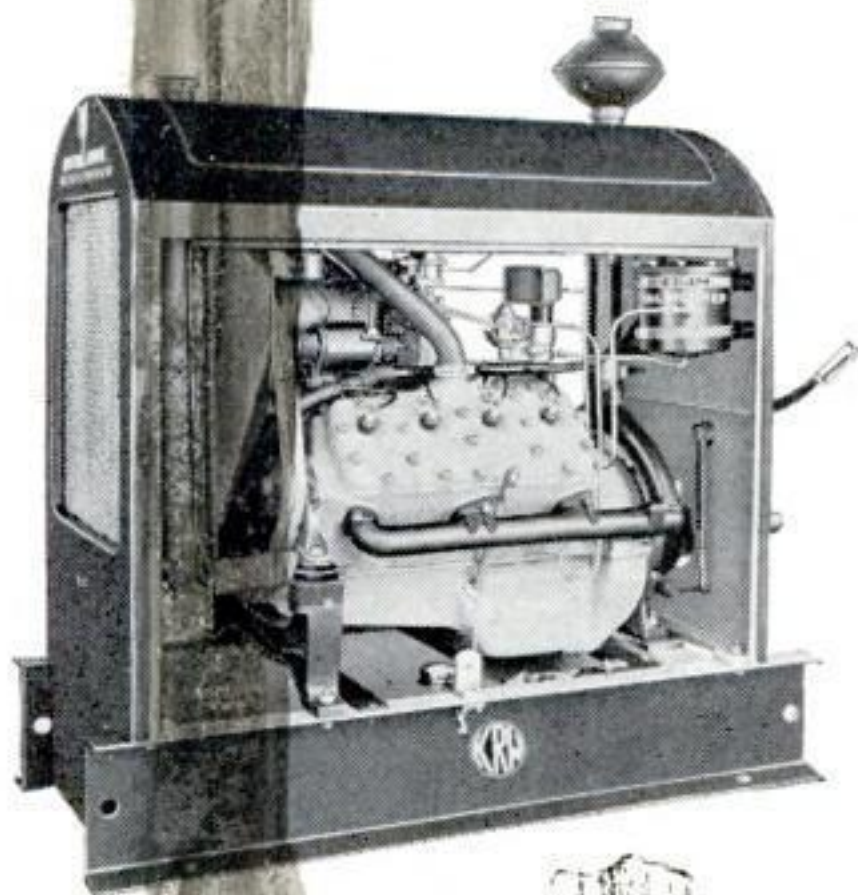
Since the "marsh buggy" operates in the water, it must be equipped in accordance with the legal requirements for small boats, the fittings including a white light visible on the full horizon and red and green lights displayed at the sides. The designers solved the problem of mounting the latter where they could be seen by placing them on a hinged rod, which can be lowered to project ahead of the front wheels. The white light, on a staff at the "stern" of the amphibian, is supported high enough to be seen over the tops of the tires. An automobile horn complies with the rule requiring a warning signal, and the prescribed copy of marine regulations is carried in a brass case beside the seat of the "pilot."

AT THE rear of the vehicle an aluminum trolley aids in loading and unloading the heavy prospecting instruments. Above it, a platform serves as a vantage point for surveying, and provides a perch for a lookout when the grass is so high that it completely obscures the driver's vision.

Even in the remotest parts of the Louisiana marshes, the crew of the odd amphibian will be in constant communication with other engineers at the base camp of the expedition. A complete, two-way short-wave radio-telephone set will enable them to report their progress, call for help in unexpected emergencies, and flash word of any important discoveries. It also will enable directing engineers to control the movements of the "marsh buggy" and forward instructions in unforeseen contingencies.

In time, other equipment will be added, as new uses are found for the strange craft in making the marshes accessible to man.

Save with this low-cost KRW-FORD V8 EQUIPMENT



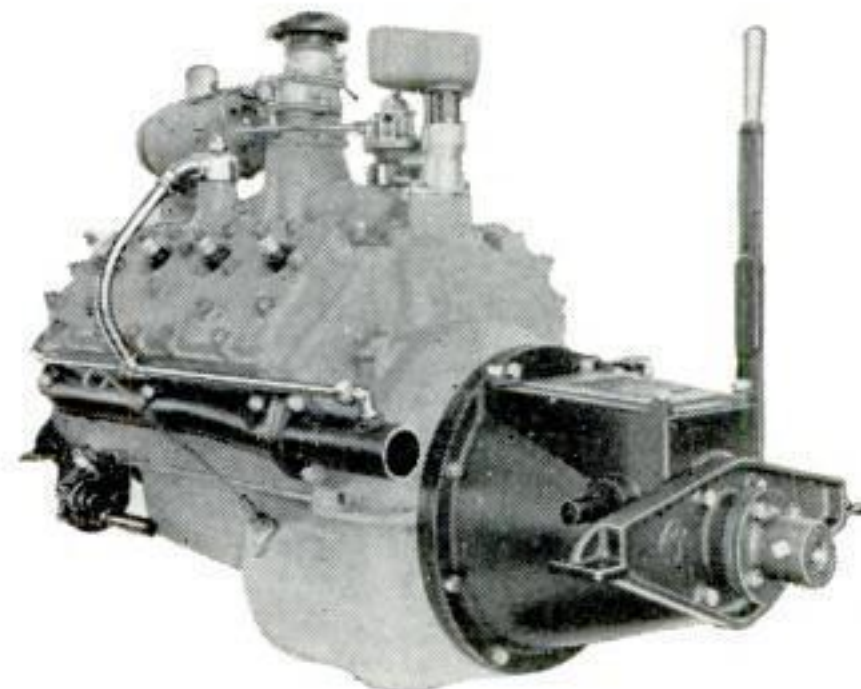
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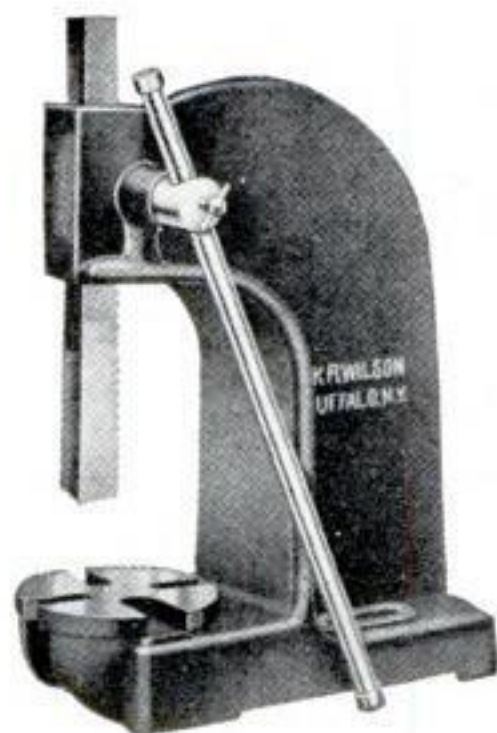
Bulletins describing KRW—FORD V8 money-saving equipment will be mailed on request. Also Bulletin describing Garage Equipment for service stations and repair shops. Get the facts—compare price, quality and performance—use the coupon.



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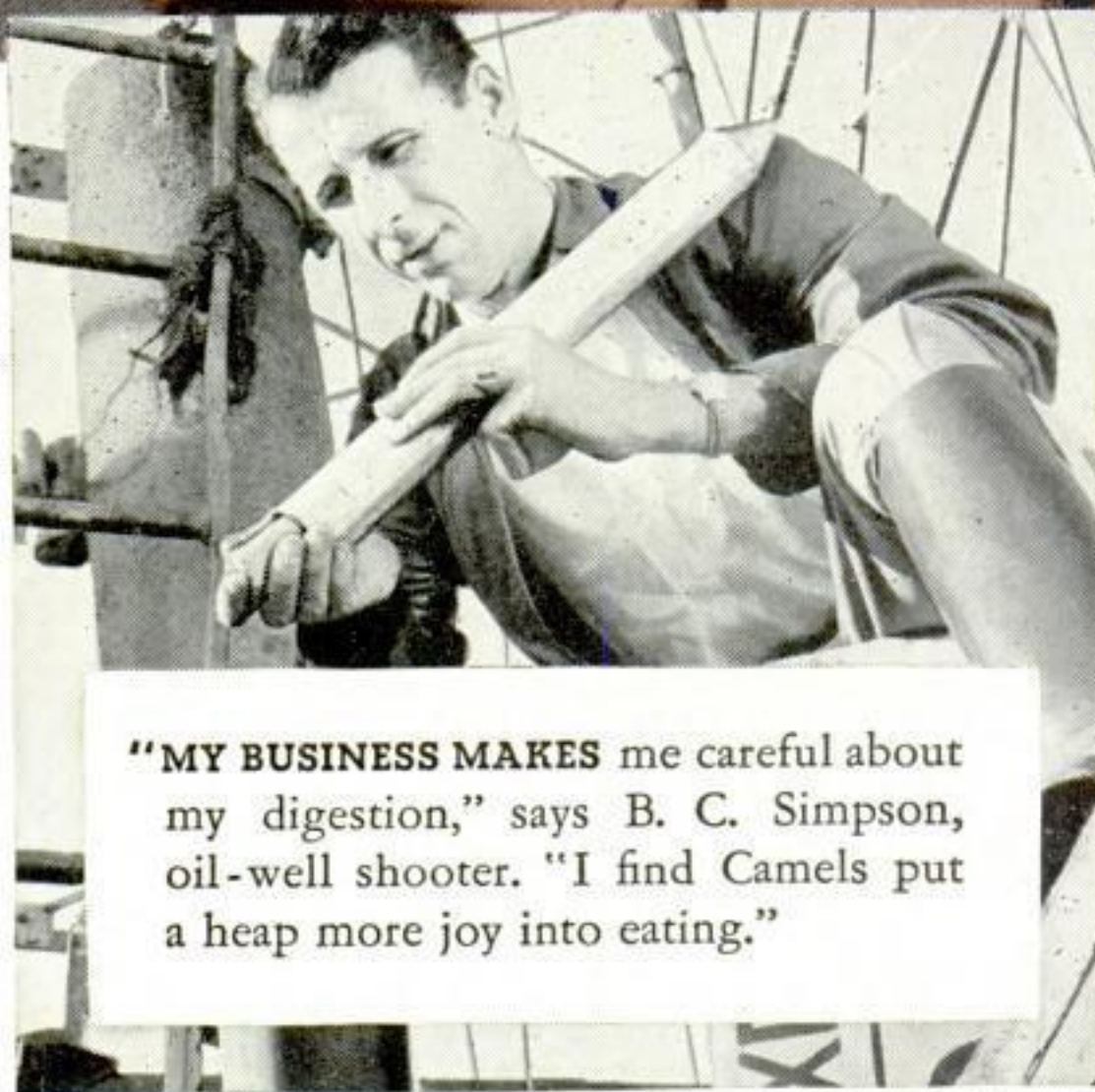
"I'll back that to the limit," says Miss Dorothy Kilgallen, spunky globe-circling girl reporter

AROUND THE WORLD IN 24 DAYS. "It was a breathless dash," said Miss Dorothy Kilgallen, famous girl reporter, back at work (*above*) after finishing her assignment to circle the world by air in record-breaking time. (*Right*) Her exciting arrival at the Newark Airport. "I snatched meals anywhere," she says, "ate all kinds of food. But Camels helped me keep my digestion tuned up. I'll bet on them any time — for mildness, for their delicate flavor, and for their cheery 'lift.' Camels set me right!"



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